USDA United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with the North Dakota Agricultural Experiment Station, North Dakota Cooperative Extension Service, and North Dakota State Soil Conservation Committee

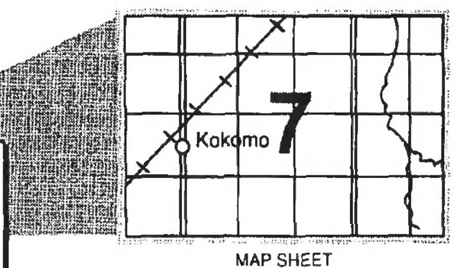
Soil Survey of Ransom County, North Dakota

How to Use This Soil Survey

General Soil Map (STATSGO)

The general soil map, which is the color map found ni the section, "General Soil Map Units (STATSGO)," shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, and then refer to the description of the area.

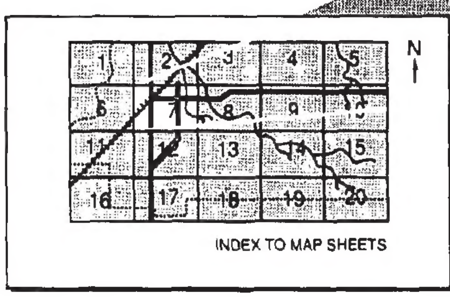


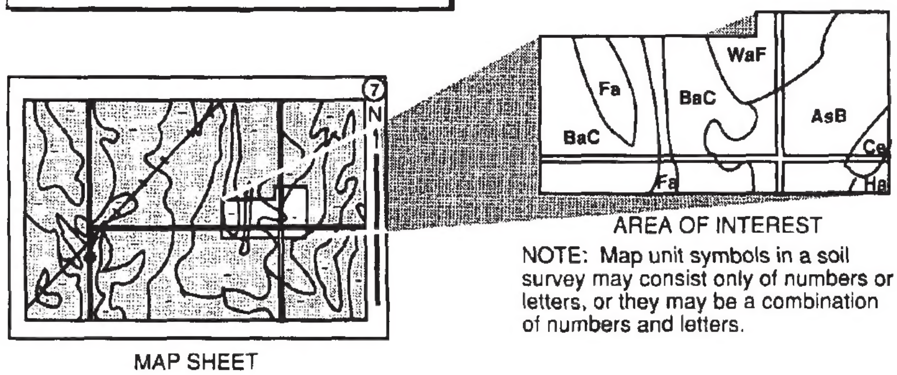
Detailed Soil Maps

The detailed soil maps are found at the back of the book. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet and turn to that sheet.

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Contents**, which lists the map units by symbol and name and shows the page where each map unit is described.





The **Contents** shows which table has data on a specific land use for each detailed soil map unit. Also see the **Contents** for sections of this publication that may address your specific needs.

For additional information concerning the use of soil surveys refer to North Dakota State University Extension Service Bulletin 60, "Soil Survey: The Foundation for Productive Natural Resource Management," (Seelig, 1993) and to the USDA-NRCS publication "From the Surface Down: An Introduction to Soil Surveys for Agronomic Use," (Broderson, 1991).

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies, including the Agricultural Experiment Station, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1991. Soil names and descriptions were approved in 1992. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1987 to 1991. This survey was made cooperatively by the Natural Resources Conservation Service, the North Dakota Agricultural Experiment Station, North Dakota Cooperative Extension Service, and North Dakota State Soil Conservation Committee. It is part of the technical assistance furnished to the Ransom County Soil Conservation District. Financial assistance was provided by the Ransom County Board of Commissioners, Ransom County Soil Conservation District, Ransom County Water Resource Board, and Ransom County Townships.

Cover: Dead Colt Creek dam and reservoir built for flood control and recreation. The soil map unit along the reservoir is Buse-Barnes loams, 15 to 35 percent slopes. Note the field windbreaks in the background. The windbreaks provide protection from wind erosion.

Contents

Issued 2002

Foreword

This soil survey contains information that can be used in land-planning programs in Ransom County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the STATSGO general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Thomas E. Jewett
State Conservationist
Natural Resources Conservation Service

Soil Survey of Ransom County, North Dakota

By Lawrence Edland, Natural Resources Conservation Service.

Fieldwork by Lawrence Edland, Robert Drew, David J. Breker, Mark Morrison, James Seaholm, Richard Pullman, Dan Brady, Natural Resources Conservation Service; Donald D. Opdahl and Nordan J. Lunde, professional soil classifiers.

United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with North Dakota Agricultural Experiment Station, North Dakota Cooperative Extension Service, North Dakota State Soil Conservation Committee, North Dakota State Department of Transportation, and the Ransom County Soil Conservation District.

Map finishing by the North Dakota State Soil Conservation Committee.

General Nature of the Survey Area

RANSOM COUNTY is located in the southeastern part of North Dakota (fig. 1). It has a total area of 552,000 acres of which 550,620 acres are land and 2,180 acres are water in bodies of more than 40 acres in size. The country is bounded on the south by Dickey and Sargent Counties, on the west by Lamoure County, on the north by Barnes and Cass Counties, and on the east by Richland County. The county seat is Lisbon, which is in the central part of the county.

Homesteading began in large numbers after the railroad line headed west from Fargo. The first settlement was Owego in the eastern part of the county in 1870. Settlement continued through the 1870s, and the first county commissioners were appointed on March 7, 1881. Eventually the county was organized with Lisbon as the county seat. Additional information concerning the history and development of Ransom County has been published by the Ransom County Historical Society (Thorfinnson,1975).

The county is in the Central Black Glaciated Plains (Major Land Resource Area 55B) and the Red River Valley of the North (Major Land Resource Area 56) portion of the Northern Great Plains Spring Wheat Region (USDA-SCS, 1981). See the Index to Map Sheets that precedes the maps to determine the extent of each Major Land Resource Area. The easternmost part of the county is in the Lake Agassiz Plain District and the central and western parts of the county are in the Drift Plains District of the Central Lowland Province (Bluemle,1979).

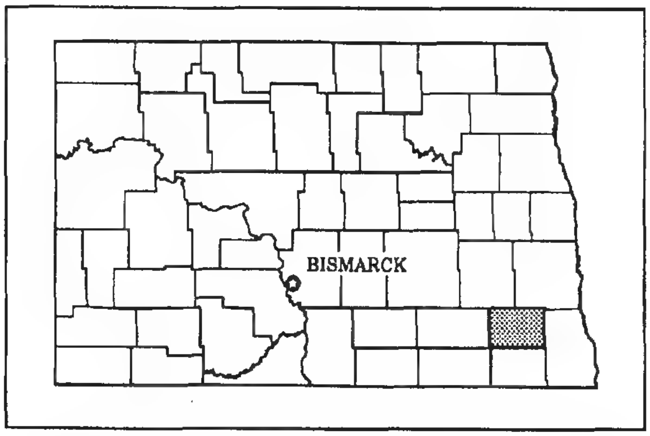


Figure 1. Location of Ransom County in North Dakota.

Farming is the main economic enterprise in the county. The principal crops are spring wheat, other small grains, corn, sunflowers, beans, grass-legume hay, and flax. The Ransom County Soil Conservation District was organized on June 22, 1945.

About 72 percent of the county is cropland or pasture, 22 percent is native rangeland, and 6 percent

is other land (USDA-SCS,1992). About half of the native rangeland is part of the Sheyenne National Grasslands. This area is administered by U.S. Forest Service and managed by the Sheyenne Valley Grazing Association. Livestock is raised primarily on the National Grasslands and on the more sloping land along the Sheyenne River. Additional information related to agriculture in Ransom County can be found in the Census of Agriculture (USDA-NASS,1999).

The soils in the county are mostly very deep and well suited to cropland, except the hilly to steep soils which are best suited to rangeland or pastureland. The soil parent material is mostly of glacial origin, with significant glaciolacustrine, till, and glaciofluvial deposits. Many of the soils are susceptible to wind or water erosion. A significant acreage of soils are wet and ponded and produce or have produced habitat for wetland wildlife.

The first soil survey of Ransom County was published in 1906 (Ely, et al. 1906). A general soil map of Ransom County was published in 1968 (Patterson, et al. 1968). Portions of Ransom County were published with the Tri-County Survey (Omodt, et al. 1966) and the Richland County and Sheyenne National Grasslands Survey (Thompson and Joos, 1975).

Climate

The climate of Ransom County is subhumid. The area is usually quite warm in summer with frequent spells of hot weather and occasional cool days. It is very cold in winter, when arctic air frequently surges over the area. Most precipitation falls in late spring and early summer.

Table 1, "Temperature and Precipitation," gives data on temperature and precipitation for the survey area as recorded at Lisbon, North Dakota, in the period 1961 to 1990. Table 2, "Freeze Dates in Spring and Fall," shows probable dates of the first freeze in fall and the last freeze in spring. Table 3, "Growing Season," provides data on length of the growing season.

In January, the average temperature is 8 degrees F, and the average daily minimum temperature is -3 degrees F. In July, the average temperature is 71 degrees F, and the average daily maximum temperature is 85 degrees F.

Growing degree days are shown in Table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The average annual total precipitation in the county is about 19 inches. Of this, about 15 inches, or 78 percent, usually falls in April through September. The growing season for commonly grown crops falls within this period. Rainfall amounts occurring in 2 years out of 10 are also shown on Table 1. The information is useful in designing a management system for wet and dry years.

Average annual snowfall is 34 inches. The average afternoon relative humidity in July is 54 percent. The sun shines 71 percent of the possible time in July and 42 percent of the time in November. The sun shines an average of 59 percent of the possible time annually. The prevailing wind is from the northwest. The average annual windspeed is 11.5 miles per hour (Jensen, 1972).

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and a discussion of the suitability, limitations, and management of the soils and miscellaneous areas for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down to the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by biological activity.

Soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their positions to specific segments of the landscape, soil scientists develop a concept, or model, of how the soils were formed. Thus, during mapping, this model enables soil scientists to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge into one another as their characteristics gradually change. To construct an accurate map, however, soil scientists must determine boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations,

supplemented by an understanding of the soil-vegetation-landscape relationships, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded characteristics of the soil profiles they studied. They noted color, texture, size, and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, soil reaction, and other features that enable them to identify soils (fig. 2). After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison and to classify soils systematically. Soil Taxonomy (Soil Survey Staff, 1975), the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After soil scientists classified and named the soils in the survey area, they compared individual soils with similar soils in the same taxonomic class in other areas so they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area are collected for laboratory analyses and for engineering tests. Soil scientists interpret data from these analyses and tests as well as field-observed characteristics and soil properties to determine expected behavior of soils under different uses. Interpretations for the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations may be developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

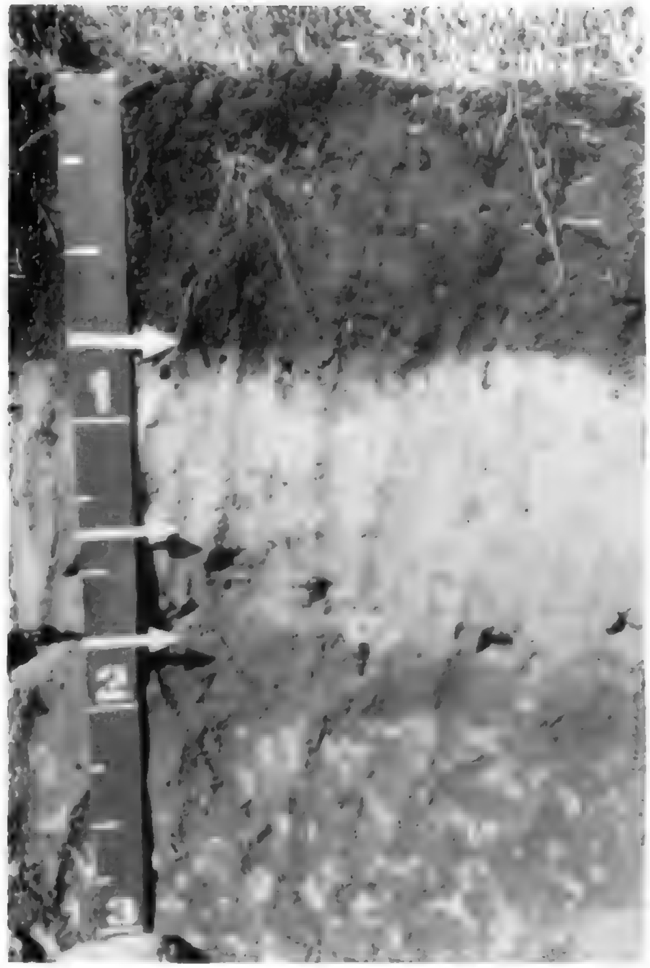


Figure 2. Profile of Hamerly loam. The dark-colored surface layer is underlain by a light colored layer that has an accumulation of lime.

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

Survey Procedures

The general procedures used to make this survey are described in the National Soil Survey Handbook (Soil Survey Staff, 1996b) and the Soil Survey Manual (Soil Survey Staff, 1993. The Major Soils of North

Dakota (Omodt, et al. 1968), Soil Taxonomy (Soil Survey Staff, 1975), and Land Resource Regions and Major Land Resource Areas of the United States (USDA-SCS, 1981), were among the references used. The procedures used in determining the nature and characteristics of the soils are described under the heading "How This Survey Was Made."

All soil mapping was done on field sheets developed from high-altitude black and white aerial photographs. The scale of the field sheets was 1:20,000 or 3.168 inches to the mile. Detail of these field sheets was checked with older aerial photography, color infrared photography, and in some instances, topographic maps. This product has been digitized and is available from the North Dakota Geological Survey office.

Soil delineations were drawn on field sheets by traversing the land on foot, by pickup with mounted hydraulic soil probe, or by all-terrain vehicle. Traverses were planned to cross all major landforms and were at intervals close enough to locate contrasting soil areas of about 3 to 5 acres. Soils were examined to a depth of 3 to 5 feet, depending on the kind of soil. Soil properties, including color, texture, structure, horizonation, and presence of salts and stones were examined.

All map units were characterized for soil variability by transecting representative areas. A transect is a series of detailed soil examinations done in a map unit delineation to determine the range of composition of various kinds of soil and soil properties. One transect was required for each 1,000 acres of the unit mapped.

Data collected from the transects were used to determine map unit names and establish the range of composition of soil in each map unit. A statistical method explained by Brubaker and Hallmark (1991) was used for the analyses. This method predicts, at a 90 percent confidence level, the average composition in the county for each named map unit component and similar soil will be between the range given in the map unit description.

Each soil map unit was documented by a least one pedon description for each soil series identified in its name. Soil pedons were sampled for soil characterization or engineering test data. The soil analyses were made by the Natural Resources Conservation Service's Soil Survey Laboratory at Lincoln, Nebraska and the North Dakota State Department of Transportation's Materials and Research Laboratory.

Table 1.—Temperature and Precipitation

(Recorded in the period 1961-90 at Lisbon, North Dakota.)

Month	Temperature						Precipitation			
	avg daily max	avg daily min	avg	2 years in 10 will have max temp. >than	2 years in 10 will have min temp. <than	avg no. of growing degree days*	avg (in.)	2 yrs in 10 will have less than (in.)	2 yrs in 10 will have more than (in.)	average number of days with 0.10 inch or more
January	18.6	-3.1	7.7	46	-34	0	0.43	0.14	0.70	1
February	25.4	3.3	14.3	51	-30	1	0.40	0.12	0.66	1
March	38.6	17.2	27.9	68	-17	24	0.97	0.51	1.37	2
April	57.0	31.3	44.1	87	9	183	1.90	0.69	3.02	4
May	70.3	42.2	56.2	92	22	502	2.47	1.28	3.52	5
June	79.2	51.5	65.3	96	36	728	3.37	1.53	4.95	6
July	85.1	56.8	70.9	101	41	950	2.89	1.33	4.24	4
August	83.2	54.0	68.6	101	36	886	2.42	1.06	3.58	4
September	72.0	43.9	58.0	96	24	540	2.01	0.64	3.13	4
October	60.1	33.2	46.6	85	12	245	1.46	0.46	2.28	3
November	39.7	18.8	29.2	67	-10	26	0.59	0.13	0.98	1
December	24.1	3.5	13.8	52	-28	1	0.50	0.16	0.88	1
Yearly :										
Average	53.2	29.0	41.1	—	—	—	—	—	—	—
Extreme	107	-40	—	103	-34	—	—	—	—	—
Total	—	—	—	—	—	3,866	17.74	13.76	20.60	32

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (Threshold: 40.0 deg. F)

Table 2.—Freeze Dates in Spring and Fall

(Recorded in the period 1961-90 at Lisbon, North Dakota.)

Probability	Temperature		
	24F or lower	28F or lower	32F or lower
Last freezing temperature in spring :			
1 year in 10 later than–	May 2	May 19	May 30
2 year in 10 later than–	May 3	May 15	May 25
5 year in 10 later than–	April 22	May 7	May 16
First freezing temperature in fall :			
1 yr in 10 earlier than–	September 26	September 17	September 9
2 yr in 10 earlier than–	October 2	September 21	September 13
5 yr in 10 earlier than–	October 13	September 29	September 19

Table 3.—Growing Season

(Recorded in the period 1961-90 at Lisbon, North Dakota.)

Probability	Daily Minimum Temperature		
	# days > 24F	# days > 28F	# days > 32F
9 years in 10	141	124	108
8 years in 10	148	130	113
5 years in 10	161	140	124
2 years in 10	173	150	135
1 year in 10	180	156	141

General Soil Map Units (STATSGO)

The general soil map which precedes the detailed soil maps was derived from STATSGO (State Soil Geographic Data Base). STATSGO (USDA-NRCS,1994) is a small scale digital general soil map of North Dakota and an accompanying data base. It shows broad areas that have a distinctive pattern of soils, relief, and drainage. These similar areas are delineated into general soil map units or soil associations. Each soil association
is a unique natural landscape. Typically, they consist of one or more major soils or components and some minor soils or components. The soils making up an association can occur in another association but in a different pattern. The STATSGO map can be used to compare the suitability of large areas for general land uses. Areas of soils suitable for a practice or use can be identified on the map. Likewise, areas that are not suitable can be identified. Broad interpretive groupings can be developed using STATSGO data. STATSGO maps are designed to be used primarily for multi-county and state resource evaluation and planning. Interpretive tables and maps can be prepared for North Dakota, or for smaller areas within the state. STATSGO maps can be used as part of a geographic information system (GIS).

The STATSGO map was compiled by generalizing more detailed soil survey maps. Information on the geology, topography, vegetation, and climate was also considered in the development of this map. The data base contains information on each association's acreage and composition. It also contains soil properties and interpretive data.

Maps were compiled at a scale of 1:250,000 (1 inch = 4 miles). The smallest delineations are about 1,500 acres in size. STATSGO maps are prepared nationwide at the same scale and join across county and state boundaries. The maps meet national standards for mapping conventions and scale. Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Descriptions for STATSGO associations in Ransom County begin on page 18. The composition of the named components in the association description includes soils that are similar in properties and behavioral patterns. Not all minor components are listed.

The North Dakota STATSGO map and data base are maintained by the USDA-NRCS Soils Staff in Bismarck, North Dakota. For more information on the use of STATSGO, or on the availability of interpretive tables and maps, contact the state NRCS office.

7—Kranzburg-Lismore Association, level to undulating

	SURFACE TEXTURE*	SLOPE PERCENT	DRAINAGE**	PERCENT COMPOSITION
MAJOR COMPONENTS				
Kranzburg	SICL	0-6	W	30-35
Lismore	SICL	0-6	MW	15-20
MINOR COMPONENTS				
Barnes	L	3-9	W	10-15
Parnell	SICL	0-1	VP	10-15
Vallers	L	0-1	P	5-10
Fargo	SIC	0-1	P	5-10

* L,loam;SIC,silty clay;SICL,silty clay loam
** VP,very poor;P,poor;MW,moderately well;W,well

Description

These soil areas consist of lacustrine-mantled till plains with nearly level and undulating topography. The dominant soils are medium to moderately-fine textured. Some poorly and very poorly drained depressions and swales exist in the area. Most areas of this association are used for cropland.

Kranzburg soils occur on the gentle, convex rises and side slopes. Lismore soils occur on lower side slopes and flats. Barnes soils occur on broad convex crests of knolls and ridges. Parnell soils occur in depressions and potholes. Fargo soils occur on broad low flats. Vallers soils occur on broad flats and adjacent to Parnell soils.

Major Limitations for Agricultural Use

These areas have few limitations for agriculture. The poor and very poorly drained soils generally have periods of wetness and ponding in the spring and after heavy rainfall. For additional information concerning these soils see "Detailed Map Unit Descriptions" and "Series Descriptions." For information concerning the limitations and hazards for agriculture see Table 6, "Potential Cropland Limitations and Management."

20—Serden-Aylmer-Rosewood Association, level to steep

	SURFACE TEXTURE*	SLOPE PERCENT	DRAINAGE**	PERCENT COMPOSITION
MAJOR COMPONENTS				
Serden	FS	3-35	E	30-35
Aylmer	FS	0-9	MW	25-30
Rosewood	FSL	0-1	P	15-20
MINOR COMPONENTS				
Hamar	LFS	0-3	SP,P	10-15
Hecla	LFS	0-6	MW	10-15
Duneland	FS	3-35	E	0-5
Maddock	LFS	3-6	W	0-5

* FSL,fine sandy loam; LFS,loamy fine sand;FS,fine sand
** P,poor;SP,somewhat poor;MW,moderately well;W,well;E,excessive

Description

These soil areas consist of level to steep duned and hummocky topography. They occur in the "sand hills" area of the Sheyenne Delta. The dominant soils are coarse textured and were deposited as alluvium and resorted by wind (fig.3). Most areas are used for rangeland and wildlife.

Serden soils occur on crests and side slopes of dunes. Aylmer soils occur on footslopes of dunes. Rosewood soils occur in depressions. Hamar soils occur in depressions and low flats. Duneland consists of areas devoid of vegetation and highly susceptible to wind erosion. Maddock soils occur on crests and upper side slopes of gently sloping hummocks. Hecla soils occur on broad flats and lower side slopes of hummocks.

Major Limitations for Agricultural Use

Severe wind erosion is a concern on all soils, and droughtiness is a concern on Serden and Maddock soils. The poorly drained Rosewood soils generally have periods of wetness and ponding in the spring and after heavy rainfall. For additional information concerning these soils see "Detailed Map Unit Descriptions" and "Series Descriptions." For information concerning the limitations and hazards for agriculture see Table 6, "Potential Cropland Limitations and Hazards."

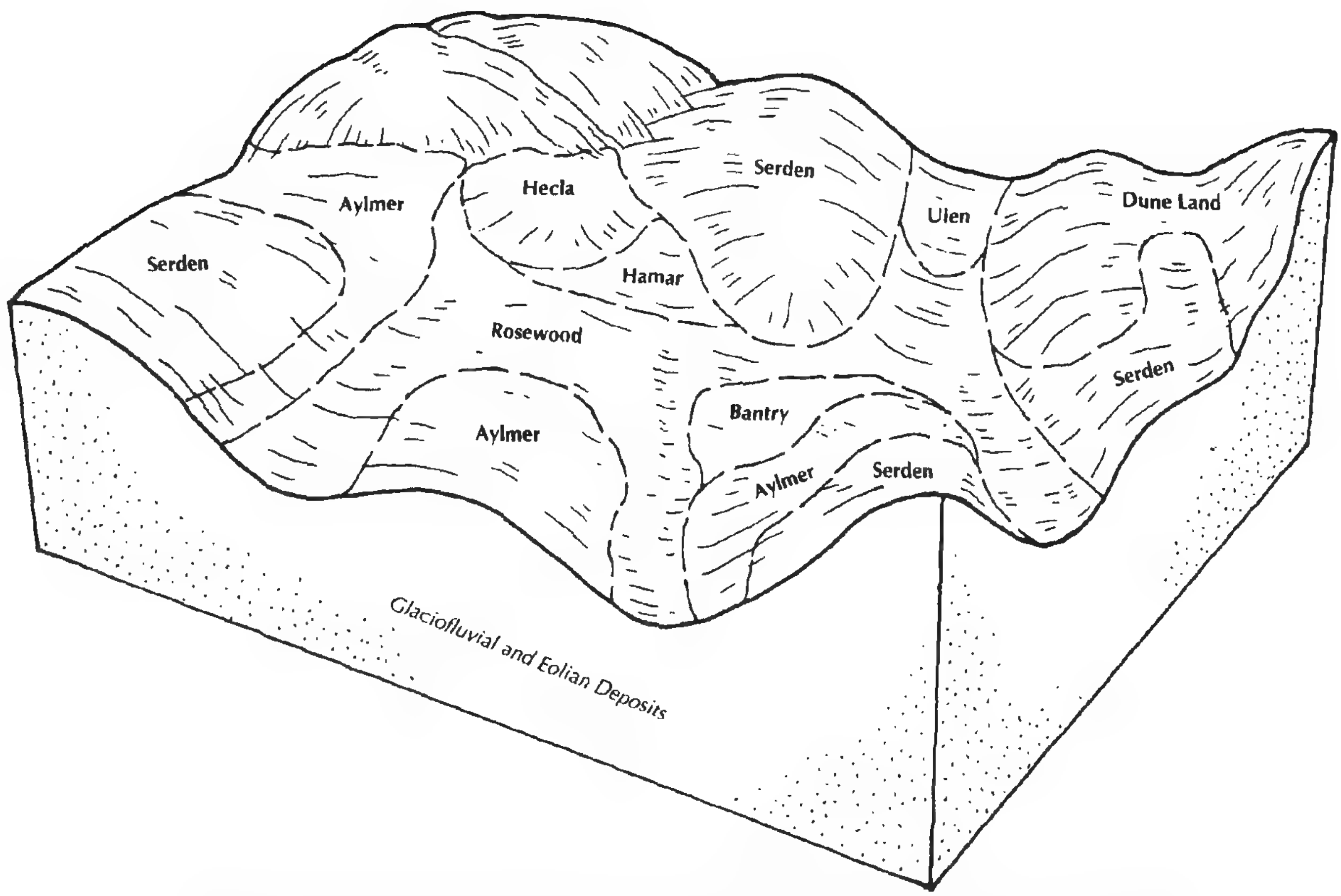


Figure 3. Typical pattern of soils and parent material in the Serden-Aylmer-Rosewood association.

21—Hecla-Hamar-Ulen Association, level to undulating

	SURFACE TEXTURE*	SLOPE PERCENT	DRAINAGE**	PERCENT COMPOSITION
MAJOR COMPONENTS				
Hecla	LFS	0-6	MW	30-35
Hamar	LFS	0-3	P,SP	20-25
Ulen	FSL	0-3	SP	20-25
MINOR COMPONENTS				
Arveson	L	0-1	P	10-15
Aylmer	FS	0-6	MW	10-15

* L,loam;FSL,fine sandy loam; LFS,loamy fine sand;FS,fine sand
** P,poor;SP,somewhat poor;MW,moderately well

Description

These soil areas consist of level to gently sloping topography with a few poorly drained depressions. They occur on glacial outwash plains and deltas. The dominant soils are coarse textured and were deposited as alluvium and resorted by wind. Most areas of this association are used for cropland.

Hecla soils occur on broad, gentle rises. Hamar soils occupy small depressions and footslopes. Ulen soils occur on broad, slightly depressed flats and in depressions. Arveson soils occupy depressions and low flats. Aylmer soils occur on slight rises with short slopes. Ulen and Arveson soils have a "high-lime" layer which occurs within plow depth. In places, this light-colored material has been exposed and mixed with dark-colored surface soil by cultivation.

Major Limitations for Agricultural Use

Wind erosion is a concern on these areas. The poorly drained Hamar and Arveson soils generally have periods of wetness and ponding in the spring and after heavy rainfall. For additional information concerning these soils see "Detailed Map Unit Descriptions" and "Series Descriptions." For information concerning the limitations and hazards for agriculture see Table 6, "Potential Cropland Limitations and Hazards."

26—Renshaw-Hecla-Divide Association, level to undulating

	SURFACE TEXTURE*	SLOPE PERCENT	DRAINAGE**	PERCENT COMPOSITION
MAJOR COMPONENTS				
Renshaw	L	0-6	SE	45-50
Hecla	LFS	0-6	MW	10-15
Divide	L	0-1	SP	10-15
MINOR COMPONENTS				
Marysland	L	0-1	P	5-10
Stirum	L	0-3	P	5-10
Glyndon	SIL	0-3	SP	0-5

* L,loam;SIL,silt loam;LFS,loamy fine sand
** P,poor;SP,somewhat poor;MW,moderately well;SE,somewhat excessive

Description

These soils areas consist of rounded knolls and low ridges separated by somewhat poorly and poorly drained depressions and drainageways. The soils formed in alluvium and occur on glacial outwash plains. The dominant soils are medium textured over sand and gravel or coarse textured throughout. Most areas of this association are used for cropland. Some of the soils are irrigated.

Renshaw soils occur on gently sloping knolls and ridges. Hecla soils occur on flats. Divide soils occur on broad, slightly depressed flats and slight rises in drainageways. Marysland soils occupy drainageways. Stirum soils occur on flats along drainageways. Glyndon soils occur on slight rises associated with Stirum soils. Divide, Marysland, Stirum, and Glyndon soils have a "high-lime" layer which occurs within plow depth. In places, this light-colored material has been exposed and mixed with dark-colored surface soil by cultivation.

Major Limitations for Agricultural Use

Wind erosion is a concern on these areas. Droughtiness is a concern on gravelly and coarse textured soils. The poorly drained soils generally have periods of wetness and ponding in the spring and after heavy rainfall. For additional information concerning these soils see "Detailed Map Unit Descriptions" and "Series Descriptions." For information concerning the limitations and hazards for agriculture see Table 6, "Potential Cropland Limitations and Hazards."

39—La Prairie-Renshaw-Buse Association, level to steep

	SURFACE TEXTURE*	SLOPE PERCENT	DRAINAGE**	PERCENT COMPOSITION
MAJOR COMPONENTS				
La Prairie	L	0-3	MW	35-40
Renshaw	L	0-6	SE	20-25
Buse	L	15-30	W	10-15
MINOR COMPONENTS				
Barnes	L	0-9	W	10-15
Sioux	GRL	6-30	E	5-10
Lamoure	SICL	0-2	P	0-5

* SICL,silty clay loam;L,loam;GRL,gravelly loam
** P,poor;MW,moderately well;W,well;SE,somewhat excessive;E,excessive

Description

These soil areas consist of nearly level, narrow bottom lands and adjacent moderately steep to steep valley sides. In places, the valley sides are dissected by deep, branching ravines that extend into the uplands. The dominant soils formed in coarse to moderately-fine textured glacial till or alluvium. These areas are used as rangeland and wildlife habitat. The bottom lands are also used as cropland. Densely wooded areas occur throughout the association.

The La Prairie and Lamoure soils occur on alluvial bottom land. Lamoure soils are poorly drained and occur in drainageways or oxbows. The Renshaw soils are on plane side slopes, and the Sioux soils are on crests of knobs and ridges. Buse soils are on steep convex shoulder slopes, and Barnes soils are on side slopes of valley walls.

Major Limitations for Agricultural Use

Flooding on bottom land soils, water erosion on steep slopes, and droughtiness on gravelly and coarse textured soils are concerns. For additional information concerning these soils see "Detailed Map Unit Descriptions" and "Series Descriptions." For information concerning the limitations and hazards for agriculture see Table 6, "Potential Cropland Limitations and Hazards."

46—Barnes-Svea-Hamerly Association, level to gently rolling

	SURFACE TEXTURE*	SLOPE PERCENT	DRAINAGE**	PERCENT COMPOSITION
MAJOR COMPONENTS				
Barnes	L	1-9	W	40-45
Svea	L	0-6	MW	20-25
Hamerly	L	0-3	SP	15-20
MINOR COMPONENTS				
Buse	L	3-9	W	5-10
Parnell	SICL	0-1	VP	1-5
Tonka	SIL	0-1	P	1-5
Cavour	L	0-3	MW	1-5

* SICL,silty clay loam;L,loam;SIL,silt loam
** VP,very poor;P,poor;SP,somewhat poor;MW,moderately well;W,well

Description

These soil areas consist of level to gently rolling topography with knolls, discontinuous ridges, and depressions. A few prominent marshes are also present. The dominant soils formed in medium textured glacial till. Nearly all the surface runoff drains into depressions (fig.4). Most areas are used for cultivated crops.

Barnes soils are on gentle, convex side slopes and broad, convex crests of knolls and ridges. Svea soils are on lower side slopes and flats. Hamerly soils are on gentle, convex positions adjacent to depressions and on flats. Buse soils are on crests and summits of knolls and ridges. Parnell and Tonka soils are in depressions and potholes. Cavour soils are on gentle, lower slopes intermingled with the Barnes and Svea soils. The Hamerly and Buse soils have a prominent "high lime" layer which occurs within plow depth. This light-colored, limy material often is exposed and mixed with dark surface soil by cultivation.

Major Limitations for Agricultural Use

Wind and water erosion are concerns on some soils. Portions of these areas have periods of wetness and ponding in the spring and after heavy rainfall. For additional information concerning these soils see "Detailed Map Unit Descriptions" and " Series Descriptions." For information concerning the limitations and hazards for agriculture see Table 6, "Potential Cropland Limitations and Management."

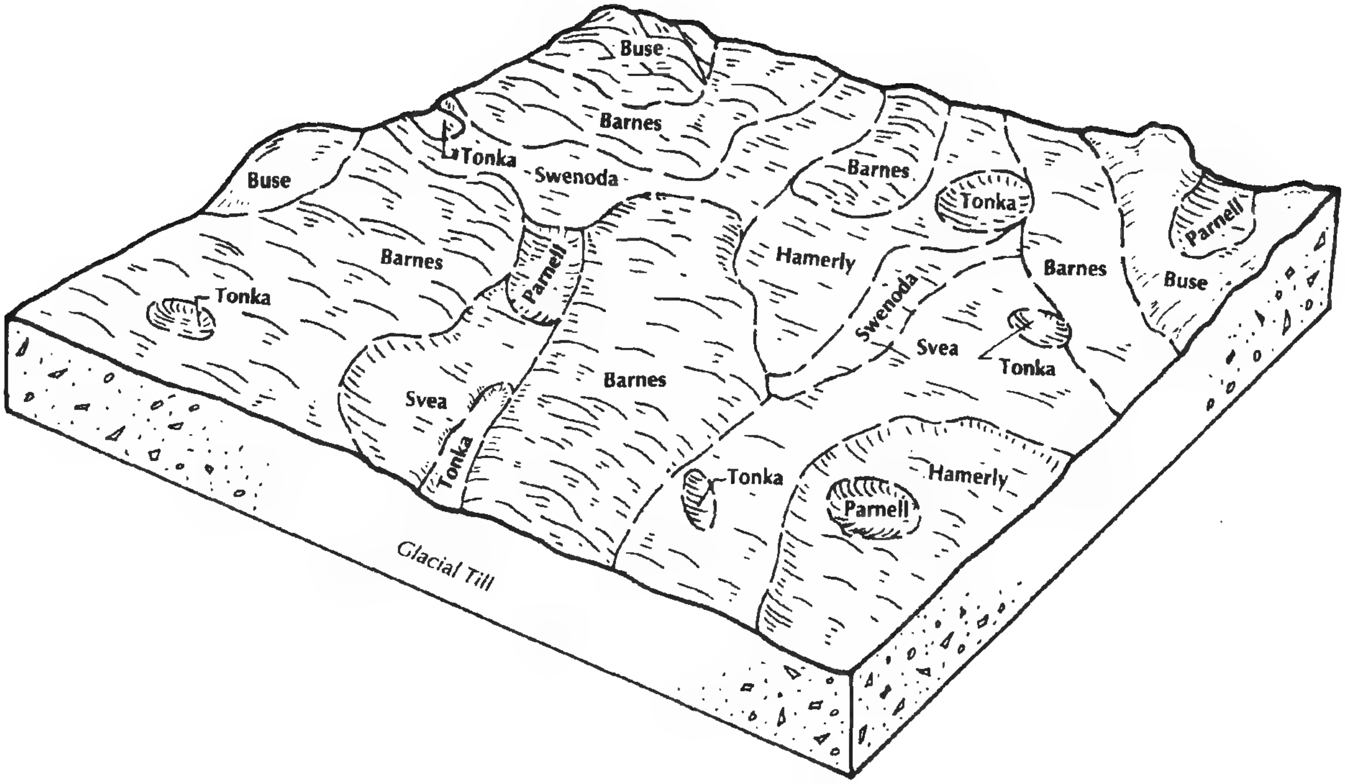


Figure 4. Typical pattern of soils and underlying material in the Barnes-Svea-Hamerly association.

65—Exline-Hegne-Stirum Association, level and nearly level

	SURFACE TEXTURE*	SLOPE PERCENT	DRAINAGE**	PERCENT COMPOSITION
MAJOR COMPONENTS				
Exline	L	0-3	SP	30-35
Hegne	SIC	0-1	P	15-20
Stirum	LS	0-1	P	15-20
MINOR COMPONENTS				
Lemert	SL	0-1	SP	10-15
Aberdeen	SIL	0-2	MW	10-15
Embden	FSL	0-3	MW	5-10
Glyndon	SIL	0-3	SP	5-10

* SIC,silty clay;L,loam;SIL,silt loam;FSL,fine sandy loam;SL,sandy loam; LS,loamy sand
** P,poor;SP,somewhat poor;MW,moderately well

Description

These soil areas consist of level and nearly level flats on glacial lake plains and beaches. The "highs" and "lows" differ in elevation by less than 2 feet. The dominant soils are moderately-coarse to fine textured. Most areas are used as rangeland or hayland.

The Exline and Lemert soils occur on slightly elevated, irregularly-shaped areas. Hegne and Glyndon soils occur on broad, low-lying flats. Stirum soils occur in slightly depressed areas. Aberdeen soils are found on slight rises above the Exline and Hegne soils. In cultivated fields, the dense subsoil of the Exline and Stirum soils is mixed in the plow layer, forming "gumbo" or "slick" spots. The Hegne and Glyndon soils have a prominent high lime layer which occurs within plow depth. This light-colored, limy material often is exposed and mixed with the dark surface soil by cultivation. In rangeland, these areas have uneven or "scabby-spot" surfaces

Major Limitations for Agricultural Use

Wind erosion is a concern on coarse-textured soils. Poor tilth, limited root and water penetration, and excess salts are concerns with the Exline, Stirum, and Lemert soils. Very poorly and poorly drained soils generally have periods of wetness and ponding in the spring and after heavy rainfall. For additional information concerning these soils see "Detailed Map Unit Descriptions" and Series Descriptions." For information concerning the limitations and hazards for agriculture see Table 6, "Potential Cropland Limitations and Hazards."

183—LaDelle-Buse-Barnes-Edgeley Association, level to steep

	SURFACE TEXTURE*	SLOPE PERCENT	DRAINAGE**	PERCENT COMPOSITION
MAJOR COMPONENTS				
LaDelle	SIL,SICL	0-6	MW	30-35
Buse	L	6-35	W	20-25
Barnes	L	3-15	W	15-20
Edgeley	L	9-35	W	10-15
MINOR COMPONENTS				
Sioux	GRL	9-25	E	5-10
Rauville	SIL	0-1	VP	1-5
Nutley	SIC	2-15	W	1-5

* L,loam;GRL,gravelly loam;SIL,silt loam;SIC,silty clay;SICL,silty clay loam
** VP,very poor;MW,moderately well;W,well;E,excessive

Description

These soil areas consist of level valleys, flood plains, and the adjacent steep, valley side slopes of the Sheyenne River Valley. The dominant soils are medium-textured glacial till, alluvium, and residuum (fig. 5). Most areas of this association are used for rangeland and wildlife habitat.

LaDelle and Rauville soils are on flood plains. Buse and Barnes soils are on the upper valley side slopes. Edgeley soils are intermingled with the Barnes soils and are underlain by shale bedrock. Sioux soils are on remnant terraces on valley side slopes and are underlain by sand and gravel. Nutley soils are on the lower side slopes.

Major Limitations for Agricultural Use

Water erosion and steep slopes are concerns on these areas. The LaDelle and Rauville soils have potential for flooding. The Edgeley and Sioux soils may be droughty. For additional information concerning these soils see "Detailed Map Unit Descriptions" and "Series Descriptions." For information concerning the limitations and hazards for agriculture see Table 6, "Potential Cropland Limitations and Management."

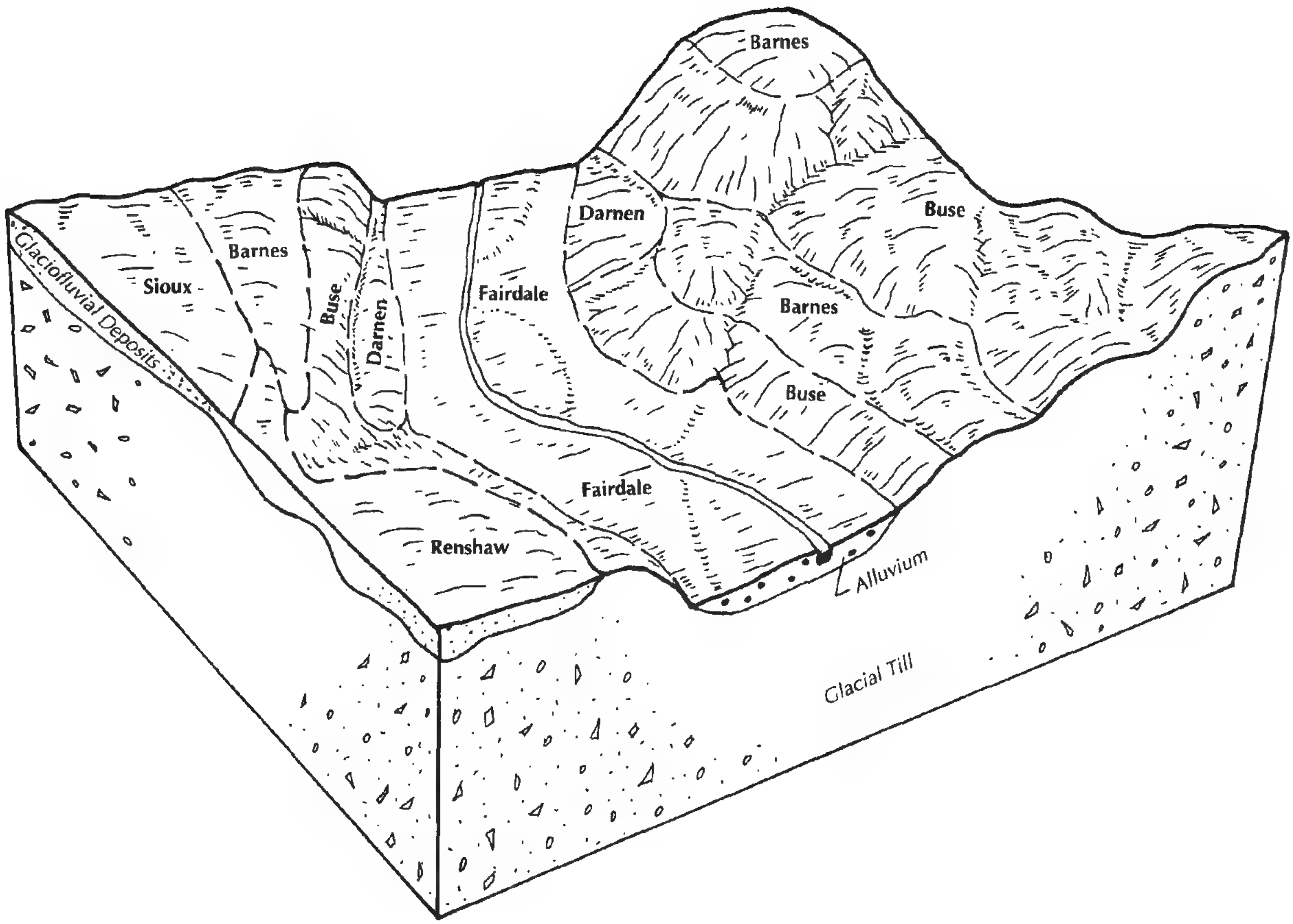


Figure 5. Typical pattern of soils and underlying material in the LaDelle-Buse-Barnes-Edgeley association.

185—Gwinner-Hamerly-Parnell Association, level and nearly level

	SURFACE TEXTURE*	SLOPE PERCENT	DRAINAGE**	PERCENT COMPOSITION
MAJOR COMPONENTS				
Gwinner	SICL	0-3	MW	25-30
Hamerly	L	0-3	SP	25-30
Parnell	SICL	0-3	VP	10-15
MINOR COMPONENTS				
Peever	CL	0-3	W	10-15
Tonka	SIL	0-3	P	5-10
Barnes	L	0-6	W	5-10
Svea	L	0-6	MW	5-10

* SICL,silty clay loam;CL,clay loam;L,loam;SIL,silt loam
** VP,very poor;P,poor;SP,somewhat poor;MW,moderately well;W,well

Description

These soil areas consist of level and nearly level topography with knolls, shallow swales, and depressions. The dominant soils formed in fine-textured alluvium underlain by glacial till and medium-textured glacial till. Most areas of this association are used for cropland.

The Gwinner and Svea soils occur on lower side slopes and flats. Hamerly soils are on gently convex positions adjacent to depressions. Parnell soils occur in depressions and potholes. Peever and Barnes soils are on gently convex side slopes and broad, convex crests of knolls and ridges. Tonka soils are in shallow depressions. The Hamerly soil has a prominent "high lime" layer which occurs within the plow depth. This light-colored, limy material often is exposed and mixed with dark surface soil by cultivation.

Major Limitations for Agricultural Use

Wind erosion is a concern on the Hamerly soils. Very poorly and poorly drained soils generally have periods of wetness and ponding in the spring and after heavy rainfall. For additional information concerning these soils see "Detailed Map Unit Descriptions" and Series Descriptions". For information concerning the limitations and hazards for agriculture see Table 6, "Potential Cropland Limitations and Hazards."

186—Ulen-Wyndmere-Rosewood Association, level

	SURFACE TEXTURE*	SLOPE PERCENT	DRAINAGE**	PERCENT COMPOSITION
MAJOR COMPONENTS				
Ulen	FSL	0-1	SP	35-40
Wyndmere	L	0-1	SP	20-25
Rosewood	FSL	0-1	P	10-15
MINOR COMPONENTS				
Hecla	LFS	0-3	MW	5-10
Divide	L	0-1	SP	5-10
Colvin	SIL	0-1	P	5-10

* L,loam;SIL,silt loam;FSL,fine sandy loam;LFS,loamy fine sand
** P,poor;SP,somewhat poor;MW,moderately well

Description

These soil areas consist of level topography with a few slight rises and poorly drained depressions. The soils formed in material deposited by water in the Sheyenne Delta. Some areas have been reworked by wind. The dominant soils are moderately-coarse and coarse textured. Most areas are used for cultivated crops.

The Ulen, Wyndmere, and Divide soils occupy broad flats and slightly elevated positions adjacent to depressions. Rosewood and Colvin soils are in depressions. Hecla soils occur on broad gentle rises. Ulen, Wyndmere, Rosewood, Divide, and Colvin soils have a prominent "high-lime" layer which occurs within plow depth. In places, this light-colored, limy material has been exposed and mixed with dark surface soil by cultivation.

Major Limitations for Agricultural Use

Wind erosion is a concern these areas. Poorly drained soils generally have periods of wetness and ponding in the spring and after heavy rainfall. For additional information concerning these soils see "Detailed Map Unit Descriptions" and "Series Descriptions." For information concerning the limitations and hazards for agriculture see Table 6, "Potential Cropland Limitations and Hazards."

187—Svea-Gardena-Eckman Association, level to undulating

	SURFACE TEXTURE*	SLOPE PERCENT	DRAINAGE**	PERCENT COMPOSITION
MAJOR COMPONENTS				
Svea	L	0-6	MW	25-30
Gardena	L	0-6	MW	25-30
Eckman	L	0-6	W	10-15
MINOR COMPONENTS				
Barnes	L	3-9	W	5-10
Southam	SIL	0-1	VP	5-10
Buse	L	3-9	W	5-10
Glyndon	L	0-1	SP	5-10

* L,loam;SIL,silt loam
** VP,very poor;SP,somewhat poor;MW,moderately well;W,well

Description

These soil areas consist of nearly level and undulating knolls and gently sloping rises separated by swales and occasional depressions. The dominant soils are medium to moderately-fine textured alluvium and glacial till. Most areas are used for cultivated crops.

The Svea and Gardena soils occupy flats and swales. Eckman and Barnes soils occur on side slopes. Southam soils are in depressions. Buse soils are on shoulder slopes of steeper areas. Glyndon soils are on flats and slightly elevated areas adjacent to depressions. Buse and Glyndon soils have a prominent "high lime" layer which occurs within plow depth. This light-colored, limy material often is exposed and mixed with dark surface soil by cultivation.

Major Limitations for Agricultural Use

These areas have few limitations for agricultural use. Very poorly drained soils generally have extended periods of ponding. For additional information concerning these soils see "Detailed Map Unit Descriptions" and "Series Descriptions." For information concerning the limitations and hazards for agriculture see Table 6, "Potential Cropland Limitations and Hazards."

188—Cavour-Cathay-Renshaw Association, level and nearly level

	SURFACE TEXTURE*	SLOPE PERCENT	DRAINAGE**	PERCENT COMPOSITION
MAJOR COMPONENTS				
Cavour	L	0-3	MW	30-35
Cathay	L	0-1	MW	15-20
Renshaw	L	0-1	SE	15-20
MINOR COMPONENTS				
Stirum	SL	0-1	P	10-15
Lemert	SL	0-1	SP	10-15
Marysland	SIL	0-1	P	5-10
Tonka	SIL	0-1	P	5-10

* L,loam;SL,sandy loam;SIL,silt loam

** P,poor;SP,somewhat poor;MW,moderately well;W,well;SE,somewhat excessive

Description

These soil areas consist of level and nearly level glacial till plains and outwash plains. The dominant soils are medium textured. Most areas are used as rangeland. Some of the Renshaw soils are irrigated.

The Cavour soils occur on slightly elevated irregularly-shaped areas. Cathay soils occur on flats. Renshaw soils occur on flats and are underlain by sand and gravel. In grassland, these areas have uneven or "scabby-spot" surfaces. In cultivated fields, the dense subsoils of the Cavour, Stirum, and Lemert soils are mixed in the plow layer, forming "gumbo" or "slick" spots. Lemert and Stirum soils are associated with Cavour and Cathay soils and occur in swales and lower lying flats. Marysland soils occur in gently concave flats and drainageways. Tonka soils are in shallow depressions and potholes.

Major Limitations for Agricultural Use

Poor tilth, limited root and water penetration, and excess salts are concerns on the Cavour, Stirum, and Lemert soils. Poorly drained soils generally have periods of wetness and ponding in the spring and after heavy rainfall. For additional information concerning these soils see "Detailed Map Unit Descriptions" and Series Descriptions." For information concerning the limitations and hazards for agriculture see Table 6, "Potential Cropland Limitations and Hazards."

Detailed Soil Map Units

Map units on the detailed soil maps represent soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the soil maps and interpretive tables, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses.

A map unit delineation on the detailed soil maps represents an area on the landscape and consists of one or more soils or miscellaneous areas. The soils or miscellaneous areas are called map unit components. The map unit descriptions in this section describe the setting of the map unit or where on the landscape named map unit components can be found. The composition, or the proportion, of various soils or miscellaneous areas of a map unit determine how a map unit is named.

A map unit is identified according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some included areas that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called similar soils. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting or dissimilar soils. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. Included soils or miscellaneous areas are mentioned in the map unit descriptions. Soil interpretations in this manuscript are for named map unit components only.

A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

The map unit descriptions on the following pages give a range in composition for the named map unit components and similar soils. They also give the average composition of named, similar, and dissimilar soils.

Soils that have profiles that are almost alike make up a soil series. Except for minor differences in texture of the surface layer or underlying layers, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of underlying layers. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into soil phases. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Barnes-Buse loams, 3 to 6 percent slopes, is one of the phases of the Barnes and Buse soils.

A complex consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately

on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Hamerly-Tonka-Parnell complex, 0 to 3 percent slopes, is an example.

This survey includes miscellaneous areas. Such areas have little or no soil material and support little or no vegetation. Pits, gravel and sand, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by special symbols on the soil maps.

The map unit descriptions on the following pages give information on each named component. Information such as surface layer texture, depth class, and drainage class are included. There is also information concerning the management of the map unit.

An identifying symbol precedes the map unit name in each map unit description. This symbol is used to identify delineations on the soil maps.

Table 5, "Acreage and Proportionate Extent of the Soils," gives the acreage and proportionate extent of each map unit in the survey area. Additional information about each named component and map unit inclusion can be found in "Soil Series and Their Morphology." Hydric soils information can be found in the section "Hydric Soils." Table 24, "Hydric Soil List" indicates the map unit components with hydric conditions. Other tables give properties of the soils and the limitations, capabilities, and potentials for many uses. The "Glossary" defines many of the terms used in describing the soils or miscellaneous areas.

64—Arveson loam

Setting

These soils are on flats and depressions on delta and outwash plains.

Map Unit Composition (percent)

Named Components

Arveson and similar soils: 60 to 85

Average Component Composition

Arveson: 64
Wyndmere: 18
Borup: 8
Divide: 4
Glyndon: 2
Stirum: 2
Tiffany: 2

Named Component Description

Arveson

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

76—Arvilla sandy loam, 0 to 6 percent slopes

Setting

These soils are on flats on outwash plains and terraces.

Map Unit Composition (percent)

Named Components

Arvilla and similar soils: 85 to 90

Average Component Composition

Arvilla: 79
Brantford: 10
Fordville: 3
Divide: 2
Embden: 2
Sioux: 2
Hecla: 2

Named Component Description

Arvilla

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)

Drainage class: Somewhat excessively drained
Slope: 0 to 6 percent
Flooding: None
Water table: None

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland and pasture

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

86—Aylmer-Bantry fine sands, 0 to 6 percent slopes

Setting

Aylmer soils are on convex shoulder slopes and backslopes. Bantry soils are on plane or concave footslopes and toeslopes. These soils are on rises on delta and outwash plains.

Map Unit Composition (percent)

Named Components

Aylmer and similar soils: 55 to 70
Bantry and similar soils: 25 to 35

Average Component Composition

Aylmer: 57
Bantry: 20
Hamar, poorly drained: 6
Hecla: 6
Serden: 5
Towner: 3
Rosewood: 2
Ulen: 1

Named Component Description

Aylmer

Surface layer texture: Fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 6 percent
Flooding: None
Water table: Seasonal

Bantry

Surface layer texture: Fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Slope: 0 to 3 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Range

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

118—Barnes-Buse loams, 3 to 6 percent slopes

Setting

Barnes soils are on side slopes and footslopes. Buse soils are on convex shoulder slopes and summits of rises. These soils are on till plains.

Map Unit Composition (percent)

Named Components

Barnes and similar soils: 35 to 50
Buse and similar soils: 25 to 35

Average Component Composition

Barnes: 40
Buse: 32
Svea: 22
Hamerly: 4
Tonka: 2

Named Component Description

Barnes

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 3 to 6 percent
Flooding: None
Water table: None

Buse

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 3 to 6 percent
Flooding: None
Water table: None
Note: In some places the surface layer of the Buse soil is 3 to 5 inches thick.

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

120—Barnes-Buse loams, 6 to 9 percent slopes

Setting

Barnes soils are on convex backslopes and footslopes. Buse soils are on convex shoulder slopes and summits. These soils are on knolls and ridges on till plains.

Map Unit Composition (percent)

Named Components

Barnes and similar soils: 40 to 60
Buse and similar soils: 25 to 50

Average Component Composition

Barnes: 48
Buse: 35
Svea: 14
Tonka: 2
Zell: 1

Named Component Description

Barnes

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 6 to 9 percent
Flooding: None
Water Table: None

Buse

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 6 to 9 percent
Flooding: None
Water Table: None

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

154—Barnes-Svea loams, 0 to 3 percent slopes

Setting

Barnes soils are on convex backslopes and summits of rises. Svea soils are on plane or convex footslopes and toeslopes of swales. These soils are on till plains (fig. 6).

Map Unit Composition (percent)

Named Components

Barnes and similar soils: 35 to 60
Svea and similar soils: 25 to 50

Average Component Composition

Barnes: 46
Svea: 39

Figure 6. An area of Map Unit 154, Barnes-Svea loams, 0 to 3 percent slopes. Note the inclusion of Tonka soil in the depression at the end of the tree row.

Hamerly: 7
Tonka: 5
Buse: 2
Parnell: 1

Named Component Description

Barnes

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 0 to 3 percent
Flooding: None
Water table: None

Svea

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 3 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

156—Barnes-Svea loams, 3 to 6 percent slopes

Setting

Barnes soils are on convex backslopes and summits of rises. Svea soils are on plane or concave footslopes and toeslopes of swales. These soils are on till plains.

Map Unit Composition (percent)

Named Components

Barnes and similar soils: 55 to 70
Svea and similar soils: 20 to 35

Average Component Composition

Barnes: 56
Svea: 28
Buse: 7
Tonka: 4
Parnell: 3

Hamerly: 1
Vallers: 1

Named Component Description

Barnes

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 3 to 6 percent
Flooding: None
Water table: None

Svea

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 3 to 6 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

314—Buse-Barnes loams, 9 to 15 percent slopes

Setting

Buse soils are on convex shoulder slopes and summits. Barnes soils are on backslopes and summits. These soils are on knolls and ridges on till plains.

Map Unit Composition (percent)

Named Components

Buse and similar soils: 40 to 60
Barnes and similar soils: 25 to 45

Average Component Composition

Buse: 53
Barnes: 31
Svea: 11
Darnen: 4
Tonka: 1

Named Component Description

Buse

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 9 to 15 percent
Flooding: None
Water table: None

Barnes

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 9 to 15 percent
Flooding: None
Water table: None
Note: In some places the surface layer of the Buse soil is 3 to 5 inches thick. In other places these soils contain more silt and less sand.

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Range and wildlife habitat

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

450—Colvin silt loam

Setting

Colvin soils are on flats and depressions on alluvial plains.

Map Unit Composition (percent)

Named Components

Colvin and similar soils: 85 to 90

Average Component Composition

Colvin: 86
Marysland: 4

Borup: 4
Parnell: 3
Divide: 2
Perella: 1

Named Component Description

Colvin

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

493—Darnen loam, 3 to 6 percent slopes

Setting

Darnen soils are on plane or concave footslopes and toeslopes of fans along stream valleys.

Map Unit Composition (percent)

Named Components

Darnen and similar soils: 90 to 95

Average Component Composition

Darnen: 80
Svea: 15
Barnes: 3
Sioux: 2

Named Component Description

Darnen

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 3 to 6 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

510—Divide loam

Setting

Divide soils are on flats or concave footslopes on outwash plains.

Map Unit Composition (percent)

Named Components

Divide and similar soils: 80 to 90

Average Component Composition

Divide: 80
Marysland: 12
Hamerly: 2
Renshaw: 2
Spottswood: 2
Parnell: 1
Arveson: 1

Named Component Description

Divide

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability,

and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

571—Embden fine sandy loam, 0 to 6 percent slopes

Setting

Embden soils are on flats or convex backslopes and footslopes of rises on delta and outwash plains.

Map Unit Composition (percent)

Named Components

Embden and similar soils: 85 to 95

Average Component Composition

Embden: 71
Clontarf: 9
Egeland: 9
Hecla: 5
Wyndmere: 4
Svea: 1
Tiffany: 1

Named Component Description

Embden

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 6 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

726—Fordville loam

Setting

Fordville soils are on flats and concave footslopes and toeslopes of rises on outwash plains and terraces.

Map Unit Composition (percent)

Named Components

Fordville and similar soils: 70 to 90

Average Component Composition

Fordville: 75
Renshaw: 15
Svea: 4
Divide: 3
Arvilla: 2
Sioux: 1

Named Component Description

Fordville

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland and pasture

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

772—Gardena-Eckman loams, 0 to 3 percent slopes

Setting

Gardena soils are on plane or concave footslopes and toeslopes of swales. Eckman soils are on plane or convex shoulder slopes and summits of rises. These soils are on lake plains.

Map Unit Composition (percent)

Named Components

Gardena and similar soils: 50 to 70
Eckman and similar soils: 25 to 35

Average Component Composition

Gardena: 60
Eckman: 27
Overly: 7
Glyndon: 3
Zell: 3

Named Component Description

Gardena

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 3 percent
Flooding: None
Water table: Seasonal

Eckman

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 0 to 3 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

794—Glyndon loam

Setting

Glyndon soils are on flats on lake plains.

Map Unit Composition (percent)

Named Components

Glyndon and similar soils: 80 to 90

Average Component Composition

Glyndon: 77
Bearden: 6
Totten: 5
Arveson: 4
Embden: 4
Perella: 3
Stirum: 1

Named Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

795—Glyndon loam, saline

Setting

Glyndon soils are on flats on lake plains.

Map Unit Composition (percent)

Named Components

Glyndon and similar soils: 85 to 95

Average Component Composition

Glyndon: 83
Bearden, saline: 10
Wyndmere: 5
Arveson: 2

Named Component Description

Glyndon

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Salt affected: Saline within 30 inches

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

852—Hamar loamy fine sand

Setting

Hamar soils are in depressions on delta plains.

Map Unit Composition (percent)

Named Components

Hamar and similar soils: 65 to 95

Average Component Composition

Hamar: 67
Hamar, somewhat poorly drained: 20
Hecla: 10
Ulen: 3

Named Component Description

Hamar

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Ponding: Long

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

883—Hamerly-Tonka-Parnell complex, 0 to 3 percent slopes

Setting

Hamerly soils are on flats and convex rims of depressions. Tonka soils are on concave toeslopes and in depressions. Parnell soils are in depressions. These soils are on till plains.

Map Unit Composition (percent)

Named Components

Hamerly and similar soils: 55 to 65
Tonka and similar soils: 20 to 30
Parnell and similar soils: 5 to 15

Average Component Composition

Hamerly: 55
Tonka: 24
Parnell: 10
Svea: 4
Barnes: 2
Vallers: 2
Buse: 1
Cresbard: 1
Perella: 1

Named Component Description

Hamerly

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)

Figure 7. An area of Map Unit 939, Hecla-Hamar loamy fine sands, 0 to 3 percent slopes. Note the area of Map Unit 2224, Serden-Hamar complex, 0 to 15 percent slopes, in the background.

Drainage class: Somewhat poorly drained
Slope: 0 to 3 percent
Flooding: None
Water table: Seasonal

Tonka

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Ponding: Very long

Parnell

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Ponding: Very long

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

939—Hecla-Hamar loamy fine sands, 0 to 3 percent slopes

Setting

Hecla soils are on plane or convex backslopes and shoulder slopes on rises. Hamar soils are on plane or concave footslopes and toeslopes of swales and in depressions. These soils are on delta plains (fig. 7).

Map Unit Composition (percent)

Named Components

Hecla and similar soils: 50 to 70
Hamar and similar soils: 20 to 30

Average Component Composition

Hecla: 62
Hamar: 24
Ulen: 4

Maddock: 3
Aylmer: 3
Hamar, poorly drained: 2
Rosewood: 1
Wyndmere: 1

Named Component Description

Hecla

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 3 percent
Flooding: None
Water table: Seasonal

Hamar

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Slope: 0 to 3 percent
Flooding: None
Water table: Seasonal
Note: In some areas, the substratum below a depth of 40 inches is silt loam or silty clay loam.

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland, pasture, hay, and range

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1030—Kranzburg-Lismore silty clay loams, 2 to 6 percent slopes

Setting

Kranzburg soils are on plane or convex backslopes and shoulder slopes of rises. Lismore soils are on plane or convex footslopes and toeslopes of swales. These soils are on till plains.

Map Unit Composition (percent)

Named Components

Kranzburg and similar soils: 55 to 70
Lismore and similar soils: 15 to 30

Average Component Composition

Kranzburg: 63
Lismore: 24
Buse: 7
Hamerly: 3
Tonka: 3

Named Component Description

Kranzburg

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 2 to 6 percent
Flooding: None
Water table: Seasonal

Lismore

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 2 to 6 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1043—La Prairie loam

Setting

La Prairie soils are on flats on flood plains.

Map Unit Composition (percent)

Named Components

La Prairie and similar soils: 90 to 95

Average Component Composition

La Prairie: 80
Fairdale: 12
Fordville: 4
La Prairie, channeled: 3
Rauville: 1

Named Component Description

La Prairie

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 1 percent
Flooding: Rare
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1055—LaDelle silt loam

Setting

LaDelle soils are on flats on flood plains.

Map Unit Composition (percent)

Named Components

LaDelle and similar soils: 90 to 95

Average Component Composition

LaDelle: 91
Lamoure: 4
LaDelle, channeled: 2
La Prairie: 2
Rauville: 1

Named Component Description

LaDelle

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 1 percent
Flooding: Rare
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1081—Lamoure silt loam

Setting

Lamoure soils are on flats on flood plains.

Map Unit Composition (percent)

Named Components

Lamoure and similar soils: 85 to 95

Average Component Composition

Lamoure: 81
Colvin: 6
Lamoure, channeled: 4
Marysland: 4
LaDelle: 2
Darnen: 2
Rauville: 1

Named Component Description

Lamoure

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Slope: 0 to 1 percent
Flooding: Rare
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1168—Lismore-Kranzburg silty clay loams, 0 to 2 percent slopes

Setting

Lismore soils are on plane or concave footslopes and toeslopes of swales. Kranzburg soils are on plane or convex backslopes and shoulder slopes of rises. These soils are on till plains.

Map Unit Composition (percent)

Named Components

Lismore and similar soils: 55 to 65
Kranzburg and similar soils: 25 to 35

Average Component Composition

Lismore: 59
Kranzburg: 30
Tonka: 7
Hamerly: 3
Great Bend: 1

Named Component Description

Lismore

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 2 percent
Flooding: None
Water table: Seasonal

Kranzburg

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 0 to 2 percent
Flooding: None
Water table: Seasonal

Note: In some places the substratums of these soils contain more clay.

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1205—Maddock loamy fine sand, 6 to 15 percent slopes

Setting

Maddock soils are on convex backslopes and summits of ridges on delta plains.

Map Unit Composition (percent)

Named Components

Maddock and similar soils: 80 to 90

Average Component Composition

Maddock: 74
Arvilla: 7
Hecla: 5
Fordville: 5
Dickey: 4
Serden: 3
Barnes: 2

Named Component Description

Maddock

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 6 to 15 percent
Flooding: None
Water table: None

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Pasture, hay, or range

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1221—Maddock-Hecla loamy fine sands, 1 to 6 percent slopes

Setting

Maddock soils are on convex backslopes and summits of rises. Hecla soils are on plane or concave footslopes and toeslopes. These soils are on delta plains.

Map Unit Composition (percent)

Named Components

Maddock and similar soils: 50 to 75
Hecla and similar soils: 20 to 40

Average Component Composition

Maddock: 58
Hecla: 25
Hamar, poorly drained: 6
Aylmer: 3
Serden: 3
Swenoda: 2
Buse: 2
Ulen: 1

Named Component Description

Maddock

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 1 to 6 percent
Flooding: None
Water table: None

Hecla

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 1 to 3 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland, pasture, hay, and range

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1269—Marysland silt loam

Setting

Marysland soils are on flats on outwash plains.

Map Unit Composition (percent)

Named Components

Marysland and similar soils: 90 to 95

Average Component Composition

Marysland: 92
Divide: 8

Named Component Description

Marysland

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Note: In some places the Marysland soil is very poorly drained.

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Range and pasture

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1403—Overly silty clay loam

Setting

Overly soils are on flats on lake plains.

Map Unit Composition (percent)

Named Components

Overly and similar soils: 65 to 85

Average Component Composition

Overly: 70
Great Bend: 19
Gardena: 5
Bearden: 3
Perella: 2
Tonka: 1

Named Component Description

Overly

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1427—Parnell silty clay loam

Setting

Parnell soils are in deep depressions on till plains.

Map Unit Composition (percent)

Named Components

Parnell and similar soils: 85 to 95

Average Component Composition

Parnell: 84
Vallers: 12
Tonka: 2
Southam: 2

Named Component Description

Parnell

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Ponding: Very long

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1466—Pits, gravel and sand

Setting

Pits, gravel and sand, occur on outwash plains and terraces.

Map Unit Composition (percent)

Named Components

Pits, sand and gravel: 90

Average Component Composition

Pits, sand and gravel: 90
Sioux: 5
Renshaw: 5

Named Component Description

Pits, sand and gravel

Definition: Areas from which soil and gravel have been removed. Some areas have been smoothed and overburden material replaced.
Slope: 0 to 60 percent
Flooding: None
Water table: None

For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1472—Rauville silty clay loam

Setting

Rauville soils are on flats on flood plains.

Map Unit Composition (percent)

Named Components

Rauville and similar soils: 80 to 90

Average Component Composition

Rauville: 80
Marysland: 15
Lamoure: 5

Named Component Description

Rauville

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Slope: 0 to 1 percent
Flooding: Frequent
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Range, hay, and wetland wildlife habitat

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1523—Renshaw loam, 0 to 3 percent slopes

Setting

Renshaw soils are on flats, convex backslopes, and concave footslopes of rises on outwash plains and terraces.

Map Unit Composition (percent)

Named Components

Renshaw and similar soils: 70 to 85

Average Component Composition

Renshaw: 73
Sioux: 14
Fordville: 13

Named Component Description

Renshaw

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Slope: 0 to 3 percent
Flooding: None
Water table: None

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland and pasture

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1560—Rifle mucky peat

Setting

Rifle mucky peat soils are on flats on terraces.

Map Unit Composition (percent)

Named Components

Rifle and similar soils: 95 to 100

Average Component Composition

Rifle: 93
Rauville: 5
Water: 2

Named Component Description

Rifle

Surface layer texture: Peat
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Ponding: Very long
Note: In some places mineral soil is within a depth of 51 inches.

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Wildlife habitat

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1577—Rosewood fine sandy loam

Setting

Rosewood soils are on flats and in depressions on delta plains.

Map Unit Composition (percent)

Named Components

Rosewood and similar soils: 80 to 90

Average Component Composition

Rosewood: 63
Fossum: 15
Ulen: 12
Venlo: 5
Rosewood, very poorly drained: 5

Named Component Description

Rosewood

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1648—Serden-Duneland complex, 1 to 35 percent slopes

Setting

Serden soils are on convex side slopes. Duneland is on convex shoulder slopes and summits. These soils are on ridges on delta plains.

Map Unit Composition (percent)

Named Components

Serden and similar soils: 60 to 80
Duneland: 20 to 35

Average Component Composition

Serden: 60
Duneland: 30
Blown-out land: 4
Minnewaukan: 3
Aylmer: 2
Bantry: 1

Named Component Description

Serden

Surface layer texture: Fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Slope: 1 to 35 percent
Flooding: None
Water table: None

Duneland

Surface layer texture: Fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Slope: 1 to 35 percent
Flooding: None
Water table: None

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Range

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1670—Ulen-Rosewood fine sandy loams

Setting

Ulen soils are on flats. Rosewood soils are in concave, shallow depressions. These soils are on delta plains.

Map Unit Composition (percent)

Named Components

Ulen and similar soils: 50 to 70
Rosewood and similar soils: 20 to 40

Average Component Composition

Ulen: 57
Rosewood: 18
Fossum: 14
Hamar: 7
Wyndmere: 4

Named Component Description

Ulen

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal

Rosewood

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland, hayland, pasture, and range

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1704—Sioux-Renshaw complex, 0 to 6 percent slopes

Setting

Sioux soils are on flats or convex shoulder slopes and summits of rises. Renshaw soils are on flats, convex backslopes, and concave footslopes of rises. These soils are on outwash plains and terraces.

Map Unit Composition (percent)

Named Components

Sioux and similar soils: 55 to 75
Renshaw and similar soils: 20 to 40

Average Component Composition

Sioux: 64
Renshaw: 30
Arvilla: 4
Divide: 2

Named Component Description

Sioux

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Slope: 1 to 6 percent
Flooding: None
Water table: None

Renshaw

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Slope: 0 to 6 percent
Flooding: None
Water table: None

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland and pasture

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1709—Southam silt loam

Setting

Southam soils are in deep depressions on till plains.

Map Unit Composition (percent)

Named Components

Southam and similar soils: 90 to 95

Average Component Composition

Southam: 85
Parnell: 10
Vallers: 5

Named Component Description

Southam

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Ponding: Very long
Salt affected: Saline within 30 inches
Note: In some places the substratum is gravelly.

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Wetland wildlife habitat.

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1772—Svea-Gardena loams

Setting

Svea and Gardena soils are intermingled on flats on lake-mantled till plains.

Map Unit Composition (percent)

Named Components

Svea and similar soils: 45 to 70
Gardena and similar soils: 20 to 45

Average Component Composition

Svea: 50
Gardena: 29
Embden: 7
Barnes: 6
Cresbard: 3
Lankin: 3
Hamerly: 1
Buse: 1

Named Component Description

Svea

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal

Gardena

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1788—Swenoda-Barnes complex, 0 to 6 percent slopes

Setting

Swenoda soils are on flats and in swales. Barnes soils are on plane or convex backslopes and summits on rises. These soils are on till plains.

Map Unit Composition (percent)

Named Components

Swenoda and similar soils: 50 to 60
Barnes and similar soils: 25 to 45

Average Component Composition

Swenoda: 45
Barnes: 25
Embden: 11
Svea: 11
Buse: 5
Towner: 3

Named Component Description

Swenoda

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 6 percent
Flooding: None
Water table: Seasonal

Barnes

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 0 to 6 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1834—Tonka silt loam

Setting

Tonka soils are in depressions on till plains.

Map Unit Composition (percent)

Named Components

Tonka and similar soils: 80 to 90

Average Component Composition

Tonka: 84
Hamerly: 12
Vallers: 4

Named Component Description

Tonka

Surface layer texture: Silt loam

Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Ponding: Very long

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland and wetland wildlife habitat

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1842—Towner loamy fine sand, 0 to 3 percent slopes

Setting

Towner soils are found on flats on delta plains.

Map Unit Composition (percent)

Named Components

Towner and similar soils: 80 to 90

Average Component Composition

Towner: 61
Lohnes: 15
Maddock: 10
Arvilla: 5
Fordville: 5
Hamar: 2
Hecla: 2

Named Component Description

Towner

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 3 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1859—Ulen fine sandy loam

Setting

Ulen soils are on flats and the rims of depressions on delta plains.

Map Unit Composition (percent)

Named Components

Ulen and similar soils: 75 to 85

Average Component Composition

Ulen: 70
Rosewood: 14
Hamar: 5
Wyndmere: 4
Divide: 3
Hecla: 2
Aylmer: 2

Named Component Description

Ulen

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1871—Vallers loam, saline

Setting

Vallers soils are on flats on till plains.

Map Unit Composition (percent)

Named Components

Vallers and similar soils: 85 to 90

Average Component Composition

Vallers, saline: 64
Hamerly, saline: 19
Parnell: 7
Vallers: 4
Easby: 4
Tonka: 2

Named Component Description

Vallers

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Salt affected: Saline within 30 inches

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Range, hay, and wetland wildlife habitat.

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1883—Vallers-Parnell complex

Setting

Vallers soils are on flats and rims of depressions. Parnell soils are in depressions. These soils are on till plains.

Map Unit Composition (percent)

Named Components

Vallers and similar soils: 75 to 90
Parnell and similar soils: 5 to 25

Average Component Composition

Vallers: 75
Parnell: 10
Hamerly: 7
Vallers, saline: 5
Divide: 2
Tonka: 1

Named Component Description

Vallers

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal

Parnell

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Ponding: Very long

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see

the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1935—Venlo fine sandy loam

Setting

Venlo soils are in depressions on delta plains.

Map Unit Composition (percent)

Named Components

Venlo and similar soils: 75 to 85

Average Component Composition

Venlo: 67
Rosewood: 16
Ulen: 7
Fossum: 7
Rauville: 3

Named Component Description

Venlo

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Ponding: Long

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Range, pasture, or hayland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1953—Wahpeton silty clay

Setting

Wahpeton soils are on flats on flood plains.

Map Unit Composition (percent)

Named Components

Wahpeton and similar soils: 80 to 90

Average Component Composition

Wahpeton: 85
Lamoure: 10
LaDelle: 5

Named Component Description

Wahpeton

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 1 percent
Water table: Seasonal
Flooding: Occasional

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

1978—Water

Setting

The soils associated with this map unit occur on till plains. Water occurs in depressions and streams.

Map Unit Composition (percent)

Named Components

Water: 90

Average Component Composition

Water: 90
Colvin, poorly drained: 5
Southam: 5

Named Component Description

Water

Definition: Areas, including ponds, lakes, streams, and reservoirs, that are covered with water in most years during the period that is warm enough for plants to grow or longer.

For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2049—Wyndmere loam

Setting

Wyndmere soils are on flats on delta plains.

Map Unit Composition (percent)

Named Components

Wyndmere and similar soils: 80 to 90

Average Component Composition

Wyndmere: 78
Divide: 8
Tiffany: 4
Arveson: 3
Embden: 3
Tonka: 3
Stirum: 1

Named Component Description

Wyndmere

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2091—Zell loam, 9 to 25 percent slopes

Setting

Zell soils are on convex backslopes and shoulder slopes of ridges on lake plains.

Map Unit Composition (percent)

Named Components

Zell and similar soils: 80 to 90

Average Component Composition

Zell: 70
Buse: 10
Eckman: 7
Gardena: 7
Sioux: 3
Langhei: 3

Named Component Description

Zell

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 9 to 25 percent
Flooding: None
Water Table: None

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Range and wildlife habitat

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2206—Barnes-Sioux complex, 3 to 9 percent slopes

Setting

Barnes soils are on plane or convex side slopes. Sioux soils are on convex summits and shoulder slopes. These soils are on eskers on till plains.

Map Unit Composition (percent)

Named Components

Barnes and similar soils: 40 to 60
Sioux and similar soils: 25 to 40

Average Component Composition

Barnes: 44
Sioux: 28
Buse: 11
Renshaw: 6
Svea: 5
Divide: 2
Hamerly: 2
Egeland: 2

Named Component Description

Barnes

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 3 to 9 percent
Flooding: None
Water table: None

Sioux

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Slope: 3 to 9 percent
Flooding: None
Water table: None

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2207—Bearden silt loam

Setting

Bearden soils are found on flats on lake plains.

Map Unit Composition (percent)

Named Components

Bearden and similar soils: 80 to 90

Average Component Composition

Bearden: 63
Glyndon: 16
Hegne: 13
Overly: 5
Perella: 3

Named Component Description

Bearden

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Slope: 0 to 1 percent
Slope shape: Plane
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see

the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2208—Brantford-Coe loams, 1 to 6 percent slopes

Setting

Brantford soils are on flats and convex backslopes and footslopes of rises. Coe soils are on convex summits and shoulders of rises. These soils are on outwash plains and terraces.

Map Unit Composition (percent)

Named Components

Brantford and similar soils: 50 to 75
Coe and similar soils: 25 to 50

Average Component Composition

Brantford: 52
Coe: 33
Vang: 7
Divide: 4
Renshaw: 4

Named Component Description

Brantford

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 1 to 6 percent
Flooding: None
Water table: None

Coe

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Slope: 1 to 6 percent
Flooding: None
Water table: None

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2209—Buse-Barnes loams, 15 to 50 percent slopes

Setting

Buse soils are on convex summits and shoulders. Barnes soils are on convex backslopes and concave footslopes. These soils are on ridges on till plains.

Map Unit Composition (percent)

Named Components

Buse and similar soils: 30 to 50
Barnes and similar soils: 30 to 50

Average Component Composition

Buse: 40
Barnes: 36
Svea: 12
Sioux: 5
Forman: 5
Maddock: 2

Named Component Description

Buse

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 15 to 50 percent
Flooding: None
Water table: None

Barnes

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 15 to 25 percent
Flooding: None
Water table: None
Note: In some places the surface layer of the Buse soils is 3 to 5 inches thick.

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Rangeland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2210—Cathay-Larson loams, bouldery

Setting

Cathay soils are on convex micro-highs. Larson soils are in concave micro-lows. These soils are on flats on till plains.

Map Unit Composition (percent)

Named Components

Cathay and similar soils: 30 to 50
Larson and similar soils: 30 to 50

Average Component Composition

Cathay: 39
Larson: 38
Svea: 15
Divide: 2
Totten: 2
Marysland: 2
Arvilla: 1
Tonka: 1

Named Component Description

Cathay

Surface layer texture: Bouldery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Sodium affected: Sodic within 30 inches

Larson

Surface layer texture: Bouldery loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Rangeland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2211—Eckman-Gardena loams, 3 to 6 percent slopes

Setting

Eckman soils are on plane or convex side slopes on rises. Gardena soils are on plane or concave footslopes and toeslopes of rises and in swales. These soils are on lake plains.

Map Unit Composition (percent)

Named Components

Eckman and similar soils: 50 to 70
Gardena and similar soils: 25 to 45

Average component Composition

Eckman: 55
Gardena: 30
Zell: 8
Embden: 5
Swenoda: 2

Named Component Description

Eckman

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 3 to 6 percent
Flooding: None
Water table: None

Gardena

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 3 to 6 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, “Soil Series and Their Morphology.” Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the “Soil Properties” section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2212—Eckman-Zell loams, 3 to 6 percent slopes

Setting

Eckman soils are on plane or convex backslopes and summits of rises. Zell soils are on convex shoulder slopes of rises. These soils are on lake plains.

Map Unit Composition (percent)

Named Components

Eckman and similar soils: 60 to 85
Zell and similar soils: 10 to 30

Average Component Composition

Eckman: 53
Zell: 20
Gardena: 17
Barnes: 4
Tonka: 3
Cresbard: 3

Named Component Description

Eckman

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 3 to 6 percent
Flooding: None
Water table: Seasonal

Zell

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 3 to 6 percent
Flooding: None
Water table: None

Detailed soil descriptions for all map unit components are in alphabetical order in the section, “Soil Series and Their Morphology.” Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the “Soil Properties” section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2213—Eckman-Zell loams, 6 to 9 percent slopes

Setting

Eckman soils are on plane or convex backslopes and concave footslopes of rises. Zell soils are on convex shoulder slopes and summits of rises. These soils are on lake plains.

Map Unit Composition (percent)

Named Components

Eckman and similar soils: 40 to 60
Zell and similar soils: 25 to 55

Average Component Composition

Eckman: 50
Zell: 35
Gardena: 8
Buse: 5
Renshaw: 2

Named Component Description

Eckman

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 6 to 9 percent

Flooding: None
Water Table: None

Zell

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 6 to 9 percent
Flooding: None
Water table: None

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2214—Exline loam

Setting

Exline soils are on flats on lake plains.

Map Unit Composition (percent)

Named Components

Exline and similar soils: 85 to 90

Average Component Composition

Exline: 68
Totten: 12
Stirum: 8
Hegne: 4
Ryan: 4
Bearden: 2
Aberdeen: 2

Named Component Description

Exline

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Range and pasture

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2215—Fairdale loam, 0 to 6 percent slopes

Setting

Fairdale soils are on flats on flood plains.

Map Unit Composition (percent)

Named Components

Fairdale and similar soils: 90 to 95

Average Component Composition

Fairdale: 81
La Prairie: 13
LaDelle: 3
Fairdale, channeled: 3

Named Component Description

Fairdale

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 6 percent
Flooding: Rare
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2216—Gwinner-Peever-Parnell complex, 0 to 3 percent slopes

Setting

Gwinner soils are on plane or concave toeslopes of rises and in swales. Peever soils are on plane or convex backslopes and shoulder slopes of rises. Parnell soils are in depressions. These soils are on till plains.

Map Unit Composition (percent)

Named Components

Gwinner and similar soils: 50 to 75
Peever and similar soils: 10 to 25
Parnell and similar soils: 10 to 15

Average Component Composition

Gwinner: 58
Peever: 16
Parnell: 9
Cresbard: 6
Lismore: 6
Tonka: 4
Hamerly: 1

Named Component Description

Gwinner

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 3 percent
Flooding: None
Water table: Seasonal

Peever

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 0 to 3 percent
Flooding: None
Water table: Seasonal

Parnell

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Ponding: Very long

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2217—Hamerly-Buse-Parnell complex, 0 to 6 percent slopes

Setting

Hamerly soils are on flats and convex rims of depressions. Buse soils are on plane or convex shoulder slopes and summits of rises. Parnell soils are in concave depressions. These soils are on till plains.

Map Unit Composition (percent)

Named Components

Hamerly and similar soils: 30 to 50
Buse and similar soils: 15 to 40
Parnell and similar soils: 15 to 30

Average Component Composition

Hamerly: 33
Buse: 20
Parnell: 15
Svea: 12
Tonka: 7
Vallers: 7
Barnes: 5
Peever: 1

Named Component Description

Hamerly

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Slope: 0 to 3 percent
Flooding: None
Water table: Seasonal

Buse

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 3 to 6 percent
Flooding: None
Water table: Seasonal

Parnell

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Ponding: Very long
Note: In some places the surface layer of the Buse soils is 3 to 5 inches thick.

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2218—Brantford-Vang loams, 1 to 3 percent slopes

Setting

Brantford soils are on plane or convex backslopes and shoulder slopes on rises. Vang soils are on flats. These soils are on outwash plains and terraces.

Map Unit Composition (percent)

Named Components

Brantford and similar soils: 60 to 70
Vang and similar soils: 25 to 35

Average Component Composition

Brantford: 65
Vang: 29
Coe: 3
Renshaw: 3

Named Component Description

Brantford

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 1 to 3 percent
Flooding: None
Water table: None

Vang

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 1 to 3 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2219—Hegne silty clay loam

Setting

Hegne soils are on flats on lake plains.

Map Unit Composition (percent)

Named Components

Hegne and similar soils: 75 to 85

Average Component Composition

Hegne: 73
Bearden: 12
Colvin: 6
Overly: 4
Aberdeen: 3
Exline: 2

Named Component Description

Hegne

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Ponding: Very long

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2220—Letcher-Lemert sandy loams

Setting

Letcher soils are on convex micro-highs on flats. Lemert soils are in concave micro-lows on flats. These soils are on lake plains.

Map Unit Composition (percent)

Named Components

Letcher and similar soils: 40 to 65
Lemert and similar soils: 30 to 55

Average Component Composition

Letcher: 54
Lemert: 30
Stirum: 12
Arveson: 4

Named Component Description

Letcher

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Sodium affected: Sodic within 30 inches

Lemert

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Range

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2221—Falsen loamy sand, 0 to 3 percent slopes

Setting

Falsen soils are on flats on outwash plains and delta plains.

Map Unit Composition (percent)

Named Components

Falsen and similar soils: 90 to 95

Average Component Composition

Falsen: 92
Maddock: 4
Claire: 2
Hecla: 2

Named Component Description

Falsen

Surface layer texture: Loamy sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 3 percent
Flooding: None
Water table: Seasonal
Note: In some places the substratum contains up to 5 percent gravel.

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland, hay, and pasture

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2222—Peever-Gwinner complex, 3 to 6 percent slopes

Setting

Peever soils are on plane or convex backslopes and shoulder slopes on rises. Gwinner soils are on plane or concave footslopes and toeslopes of rises and in swales. These soils are on till plains.

Map Unit Composition (percent)

Named Components

Peever and similar soils: 40 to 50
Gwinner and similar soils: 25 to 50

Average Component Composition

Peever: 38
Gwinner: 36
Forman: 8
Buse: 6
Hamerly: 6
Cresbard: 4
Parnell: 2

Named Component Description

Peever

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Slope: 3 to 6 percent
Flooding: None
Water table: Seasonal

Gwinner

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 3 to 6 percent
Flooding: None
Water table: Seasonal

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2223—Renshaw-Sioux complex, 0 to 6 percent slopes

Setting

Renshaw soils are on flats or concave footslopes and toeslopes of ridges. Sioux soils are on plane or convex backslopes and shoulder slopes of ridges. These soils are found on outwash plains and terraces.

Map Unit Composition (percent)

Named Components

Renshaw and similar soils: 55 to 80
Sioux and similar soils: 15 to 35

Average Component Composition

Renshaw: 52
Sioux: 22
Fordville: 17
Arvilla: 6
Divide: 3

Named Component Description

Renshaw

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Slope: 0 to 6 percent
Flooding: None
Water table: None

Sioux

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Slope: 1 to 6 percent
Flooding: None
Water table: None

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Cropland, pasture, and hayland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2224—Serden-Hamar complex, 0 to 15 percent slopes

Setting

Serden soils are on convex shoulder slopes and summits of rises and knolls. Hamar soils are in depressions and swales on flats. These soils are on delta plains.

Map Unit Composition (percent)

Named Components

Serden and similar soils: 60 to 80
Hamar and similar soils: 15 to 30

Average Component Composition

Serden: 60
Hamar: 20
Aylmer: 7
Duneland: 5
Rosewood: 4
Ulen: 3
Maddock: 1

Named Component Description

Serden

Surface layer texture: Fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Slope: 3 to 15 percent
Flooding: None
Water table: None

Hamar

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Slope: 0 to 3 percent
Flooding: None
Water table: Seasonal
Ponding: Long

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Rangeland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2225—Sioux cobbly sandy loam, 6 to 15 percent slopes

Setting

Sioux soils are on convex shoulder slopes and summits of ridges on outwash plains and terraces.

Map Unit Composition (percent)

Named Components

Sioux and similar soils: 85 to 95

Average Component Composition

Sioux: 66
Renshaw: 26
Fordville: 6
Buse: 2

Named Component Description

Sioux

Surface layer texture: Cobbly sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Slope: 6 to 15 percent
Flooding: None
Water table: None

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Range and wildlife habitat

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2226—Stirum-Lemert sandy loams

Setting

Stirum soils are in concave micro-lows on flats. Lemert soils are on convex micro-highs on flats. These soils are on delta plains and lake plains.

Map Unit Composition (percent)

Named Components

Stirum and similar soils: 60 to 70
Lemert and similar soils: 25 to 35

Average Component Composition

Stirum: 55
Lemert: 27
Totten: 11
Letcher: 4
Arveson, saline: 1
Wyndmere: 1
Glyndon: 1

Named Component Description

Stirum

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Ponding: Long
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches

Lemert

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction is available in the "Soil Properties" section.

Management

Major use: Rangeland, pasture, and hayland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

2228—Aylmer-Rosewood-Serden complex, 0 to 9 percent slopes

Aylmer soils are on plane backslopes and footslopes of ridges and knolls. Rosewood soils are on flats. Serden soils are on plane or convex shoulder slopes and summits of ridges and knolls. These soils are on delta plains.

Map Unit Composition (percent)

Named Components

Aylmer and similar soils: 30 to 50
Rosewood and similar soils: 25 to 40
Serden and similar soils: 5 to 20

Average Component Composition

Aylmer: 40
Rosewood: 30
Serden: 14
Ulen: 9
Bantry: 4
Fossum: 2
Dune land: 1

Named Component Description

Aylmer

Surface layer texture: Fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Slope: 0 to 6 percent
Flooding: None
Water table: Seasonal

Rosewood

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Slope: 0 to 1 percent
Flooding: None
Water table: Seasonal

Serden

Surface layer texture: Fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Slope: 0 to 9 percent
Flooding: None
Water Table: None

Detailed soil descriptions for all map unit components are in alphabetical order in the section, "Soil Series and Their Morphology." Additional information specific to this map unit, such as USDA textures, permeability, and soil reaction, is available in the "Soil Properties" section.

Management

Major use: Rangeland

For cropland limitations and hazards see Table 6. For information about managing this map unit, see the following sections: Agronomy, Rangeland, Recreation, Wildlife Habitat, Engineering, and Soil Properties.

Table 4.—Acreage and Proportionate Extent of the Soils

Map Symbol	Soil Name	Acres	Percent
64	Arveson loam	2,980	0.5
76	Arvilla sandy loam, 0 to 6 percent slopes	8,545	1.5
86	Aylmer-Bantry fine sands, 0 to 6 percent slopes	5,550	1.0
118	Barnes-Buse loams, 3 to 6 percent slopes	49,360	8.9
120	Barnes-Buse loams, 6 to 9 percent slopes	17,975	3.3
154	Barnes-Svea loams, 0 to 3 percent slopes	51,955	9.4
156	Barnes-Svea loams, 3 to 6 percent slopes	57,855	10.5
314	Buse-Barnes loams, 9 to 15 percent slopes	6,340	1.1
450	Colvin silt loam	3,165	0.6
493	Darnen loam, 3 to 6 percent slopes	1,555	0.3
510	Divide loam	11,130	2.0
571	Embden fine sandy loam, 0 to 6 percent slopes	6,215	1.1
726	Fordville loam	5,735	1.0
772	Gardena-Eckman loams, 0 to 3 percent slopes	4,425	0.8
794	Glyndon loam	3,945	0.7
795	Glyndon loam, saline	425	*
852	Hamar loamy fine sand	1,100	0.2
883	Hamerly-Tonka-Parnell complex, 0 to 3 percent slopes	57,470	10.4
939	Hecla-Hamar loamy fine sands, 0 to 3 percent slopes	27,060	4.9
1030	Kranzburg-Lismore silty clay loams, 2 to 6 percent slopes	240	*
1043	La Prairie loam	3,620	0.7
1055	LaDelle silt loam	2,430	0.4
1081	Lamoure silt loam	1,115	0.2
1168	Lismore-Kranzburg silty clay loams, 0 to 2 percent slopes	980	0.2
1205	Maddock loamy fine sand, 6 to 15 percent slopes	1,385	0.3
1221	Maddock-Hecla loamy fine sands, 1 to 6 percent slopes	6,505	1.2
1269	Marysland silt loam	2,975	0.5
1403	Overly silty clay loam	1,940	0.4
1427	Parnell silty clay loam	6,270	1.1
1466	Pits, sand and gravel	595	0.1
1472	Rauville silty clay loam	1,295	0.2
1523	Renshaw loam, 0 to 3 percent slopes	8,250	1.5
1560	Rifle mucky peat	115	*
1577	Rosewood fine sandy loam	7,745	1.4
1648	Serden-Duneland complex, 1 to 35 percent slopes	7,165	1.3
1670	Ulen-Rosewood fine sandy loams	6,995	1.3
1704	Sioux-Renshaw complex, 0 to 6 percent slopes	11,835	2.1
1709	Southam silt loam	4,660	0.8
1772	Svea-Gardena loams	7,160	1.3
1788	Swenoda-Barnes complex, 0 to 6 percent slopes	4,685	0.8
1834	Tonka silt loam	1,785	0.3
1842	Towner loamy fine sand, 0 to 3 percent slopes	1,265	0.2
1859	Ulen fine sandy loam	9,625	1.7
1871	Vallers loam, saline	1,875	0.3
1883	Vallers-Parnell complex	4,115	0.7
1935	Venlo fine sandy loam	750	0.1
1953	Wahpeton silty clay	195	*
1978	Water	2,180	0.4
2049	Wyndmere loam	10,450	1.9
2091	Zell loam, 9 to 25 percent slopes	715	0.1
2206	Barnes-Sioux complex, 3 to 9 percent slopes	2,400	0.4
2207	Bearden silt loam	1,105	0.2
2208	Brantford-Coe loams, 1 to 6 percent slopes	2,220	0.4
2209	Buse-Barnes loams, 15 to 50 percent slopes	14,520	2.6
2210	Cathay-Larson loams, bouldery	1,360	0.2
2211	Eckman-Gardena loams, 3 to 6 percent slopes	2,260	0.4
2212	Eckman-Zell loams, 3 to 6 percent slopes	1,100	0.2
2213	Eckman-Zell loams, 6 to 9 percent slopes	530	*
2214	Exline loam	1,410	0.3
2215	Fairdale loam, 0 to 6 percent slopes	9,690	1.8
2216	Gwinner-Peever-Parnell complex, 0 to 3 percent slopes	10,135	1.8

Table 4.--Acreage and Proportionate Extent of the Soils--(continued)

Map Symbol	Soil Name	Acres	Percent
2217	Hamerly-Buse-Parnell complex, 0 to 6 percent slopes	2,165	0.4
2218	Brantford-Vang loams, 1 to 3 percent slopes	2,785	0.5
2219	Hegne silty clay loam	620	0.1
2220	Letcher-Lemert sandy loams	790	0.1
2221	Falsen loamy sand, 0 to 3 percent slopes	3,920	0.7
2222	Peever-Gwinner complex, 3 to 6 percent slopes	2,000	0.4
2223	Renshaw-Sioux complex, 0 to 6 percent slopes	11,895	2.2
2224	Serden-Hamar complex, 0 to 15 percent slopes	15,505	2.8
2225	Sioux cobbly sandy loam, 6 to 15 percent slopes	3,835	0.7
2226	Stirum-Lemert sandy loams	2,495	0.5
2228	Aylmer-Rosewood-Serden complex, 0 to 9 percent slopes	16,360	3.0
	Total	552,800	100.0

* less than 0.1 percent

Formation and Classification of the Soils

This section relates the soils in the survey area to the major factors of soil formation and describes the system of soil classification.

Formation of the Soils

Soil forms through processes acting on deposited or accumulated geologic material. Characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time that forces of soil formation have acted on the soil material.

Climate and plant and animal life are active factors of soil formation. They act on the parent material that has accumulated through the weathering of geological deposits and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. Finally, time is needed for changing the parent material into soil. Some time is always required for the differentiation of soil horizons. Usually, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effects of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the limits of the chemical and mineralogy composition of the soil. The soils of Ransom County formed in glacial drift. The advancing glacier picked up rocks and soil, ground and mixed them, and deposited the material as the glacier receded. Some soils, such as Barnes and Svea, formed in unsorted material, or glacial till. Some soils such as Glyndon and Gardena formed in glaciolacustrine deposits, or glacial material deposited by water in glacial lakes. Other soils, such as Arvilla and Sioux, formed in glaciofluvial deposits, or material deposited by glacial meltwater.

Although the parent materials are of common glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited.

Several processes have been involved in the formation of soils in Ransom County. These processes are accumulation of organic matter; solution, transfer, and removal of calcium carbonates and bases; and liberation and translocation of silicate clay minerals. In most soils more than one of these processes have been active in horizon differentiation.

The parent materials in which most of the soils developed initially contained generous amounts of calcium and magnesium carbonate minerals. These minerals have been dissolved by water and removed from the upper horizons of the soil profile. Pure water is not an effective agent for dissolving calcium and magnesium carbonates. These minerals are only slightly soluble in pure water, but become moderately soluble and dissolve much more rapidly in a weak acid. The respiratory activity of plants is a significant factor in dissolving calcium and magnesium carbonates. As plants respire, they give off carbon dioxide. Carbon dioxide dissolves in water to form a weak carbonic acid solution. This facilitates dissolving calcium and magnesium carbonates in the soil.

In a dissolved state, calcium and magnesium are in the form of ions that have a positive net electrical charge. Calcium and magnesium ions are essential elements in plant nutrition, and can either be taken up by plant roots or carried away (leached) with moving soil water. Some of the calcium and magnesium ions are leached from the soil profiles. "Seep" sites along steep slopes that have deposits of recently precipitated calcium and magnesium carbonates provide evidence of leaching.

A large number of the calcium and magnesium ions that dissolved from carbonate mineral ions are translocated to upper soil horizons by a cyclical process of root uptake and ultimate release when plant material decomposes. As vegetation decays, positively charged calcium and magnesium ions move downward

with water to the upper horizons of soil profiles. There they are held by the electrostatic forces of negatively charged clay particles and are again available for plant uptake.

Climate

Climate has direct and indirect effects on the formation of soils. Precipitation, temperature, and wind directly affect the weathering and reworking of soil material. The climate indirectly affects soil formation through its effects on the amount and kind of vegetation and animal life on or in the soil.

In addition to weathering soil material, precipitation and temperature affect the leaching and redistribution of carbonates and clay particles and the accumulation of organic matter in the soil. Freezing and thawing help break down soil particles in the parent material, thereby providing more surface area for chemical processes. Cool temperatures affect the content of organic matter by slowing the decay of plant material and animal remains.

Ransom County has a continental, subhumid climate characterized by long, cold winters and short, warm summers. The soil is generally frozen to a depth of 3 to 6 feet from November to April. During this time, except for some effects of frost action, the soil forming processes are mostly dormant. Most of the precipitation falls during the growing season and is distributed in an erratic pattern. It is during this part of the year that soil forming processes influenced by climate are most active. The climate is fairly uniform throughout the county.

Living Organisms

Soils in Ransom County formed mainly under grassland vegetation. Grasses provide a plentiful supply of organic matter, which improves the chemical and physical properties of the soil. Fibrous roots of these grasses penetrate the soil to a depth of several feet, making it more porous and more granular. As a result of these changes in the soil, less water runs off the surface and more moisture is available for increased microbiological activity. Decay of plants improves the available water capacity, tilth, and fertility of the soil. Decayed organic matter, accumulating over long periods, gives the surface layer its dark color.

On somewhat poorly drained and moderately well drained, nearly level soils, such as Gardena, Glyndon, Hamerly, Lismore, Overly, and Svea, the native vegetation is mainly tall and medium-sized grasses. Principal grasses are big bluestem, switchgrass, indiangrass, and little bluestem.

On well drained and excessively drained, nearly level to steep soils, such as Buse and Coe, short and medium-sized grasses are dominant. Among these grasses are green needlegrass, western wheatgrass, little bluestem, sideoats grama, plains muhly, and blue grama.

On the poorly drained and very poorly drained, depressional soils such as Colvin, Parnell, and Tonka, the vegetation consists of tall grasses, reeds, rivergrass, slough sedge, American mannagrass, northern reedgrass, and prairie cordgrass.

Micro-organisms have important effects on soil formation because they feed on undecomposed organic matter and convert it into humus from which plants can obtain nutrients for growth. Bacteria and different kinds of fungi attack leaves and other forms of organic matter. Insects, earthworms, and small burrowing animals help mix the humus with the soil.

Human activities greatly affect soil formation. Management measures can alter soil drainage. They can help to control erosion, thus maintaining fertility. Poor management can increase the susceptibility to erosion and thus result in an unproductive soil.

Topography

Most of Ransom County is level to undulating, but some areas are rolling to steep. Many poorly drained and very poorly drained soils in depressions receive runoff from higher elevations. The steepest areas are end moraines and breaks around rivers and drainageways. Local differences in relief within a square mile range from less than 50 feet to 150 feet.

Relief influences the formation of soil through its effect on drainage, runoff, and erosion. Many differences in the soils of this county result from their topographic position. Among these differences are drainage, thickness of the A horizon, content of organic matter, color, features of the subsoil, thickness of the solum, and degree of horizon differentiation.

Runoff is rapid on steep slopes, and only a small percentage of the rainfall penetrates the soil. Under these conditions, there is little moisture for plant growth and soil development. The soils on steeper slopes are thin and low in organic matter content. They have weak horizonation. Examples are the Buse and Zell soils.

Soils on nearly level to rolling slopes are moderately well drained and well drained. Moisture is sufficient to support good stands of mixed native grasses, and the soils have well developed profiles characterized by a black to very dark gray A horizon and a brown to very dark brown B horizon. Examples are the Barnes, Eckman, and Kranzburg soils. Most of the moderately well drained soils occur on level or slightly concave areas. They generally have a thicker A horizon, a darker colored B horizon, and a greater depth to lime

than those on convex, undulating, or rolling landscapes. Examples are the Swenoda and Svea soils.

Depressional areas that receive large amounts of runoff from higher elevations have somewhat poor to very poor natural drainage. Soils formed in depressions vary widely in profile development, depending on the degree of wetness. Parnell and Tonka soils, which are in shallow depressions, exhibit an advanced degree of horizonation because of alternate wet and dry cycles that occur in these depressions. These soils have properties much like soils from areas of much higher precipitation. They are examples of soils in which translocated clays have accumulated in the Bt horizon. Gleying, or the reduction and transfer of iron, has occurred to some degree in all of the very poorly to somewhat poorly drained soils in the county. In these naturally wet soils, this process has had a significant influence on horizon differentiation. The gray color and redoximorphic features of the subsoil indicate the redistribution of reduced iron oxides. Southam soils, which are in deep depressions, are nearly continuously wet and have a thick surface layer and carbonates throughout. Horizonation in these soils is minimal and mostly the result of sedimentary rather than soil-forming processes.

Ransom County has five areas with unique physiographic features (Bluemle, 1979). The largest area is the glaciated plains covering the central two-thirds of the county. The glaciated plains consist mainly of undulating to rolling glacial sediments with numerous potholes and poorly integrated drainage. Some soils, such as Barnes and Svea, formed in unsorted material or glacial till.

The next largest region is the Sheyenne Delta, which covers much of eastern Ransom County. This area is an undulating plain that consists of fine sand and silt that were deposited at the mouth of the Sheyenne River in glacial Lake Agassiz. Windblown dunes are common over much of the area. Soils such as Serden and Maddock formed in wind and water sorted sands in the Sheyenne Delta.

Other soils such as Renshaw and Divide formed in a generally level region in the western part of Ransom County consisting largely of glaciofluvial sand and gravel intermingled with hilly areas of till.

An area of north-central Ransom County is silty till with undulating topography familiar to the glaciated plains. The area consists of lake and shoreline sediments that were deposited largely on stagnant glacial ice.

The Sheyenne River physiographic area runs diagonally across the county and provides many scenic vistas. The river escarpments are about 200 feet deep near Fort Ransom. In that area, the Cretaceous-aged Niobrara and Pierre formations are exposed on valley walls. The valley decreases in depth to about 50 feet deep in the eastern part of the country where it dissects the Sheyenne Delta. Alluvial soils such as Fairdale and LaDelle formed on the flood plain of the Sheyenne.

The Sheyenne River drains most of Ransom County (fig. 8). The north-central part of the county is drained by the Maple River. The Sheyenne and Maple Rivers drain into the Red River of the North and eventually Hudson Bay. The extreme western part of the county, which is drained by Bear Creek into the James River, is part of the Missouri River system and drains into the Gulf of Mexico. Information concerning the ground water resources in Ransom County has been compiled by Armstrong (1982).

Time

The formation of soil is a very slow process. Much time is required for the processes of soil formation to act on the parent material and to form distinct horizons within the soil profile. Approximately 10,000 to 12,000 years have passed since the glacier receded from Ransom County (Bluemle, 1979). In geological terms, the soils in the county are young.

More time has been available for the formation of Barnes soils on glacial till plains than for the formation of Lamoure soils on flood plains. The forces of soil formation have been continually acting on the parent material of the Barnes soils; however, Lamoure soils are continually gaining new parent material at the surface as a result of flooding. Barnes soils have well-defined horizons whereas Lamoure soils have less distinct horizons.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1975, 1996a). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 5, "Classification of the Soils" shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

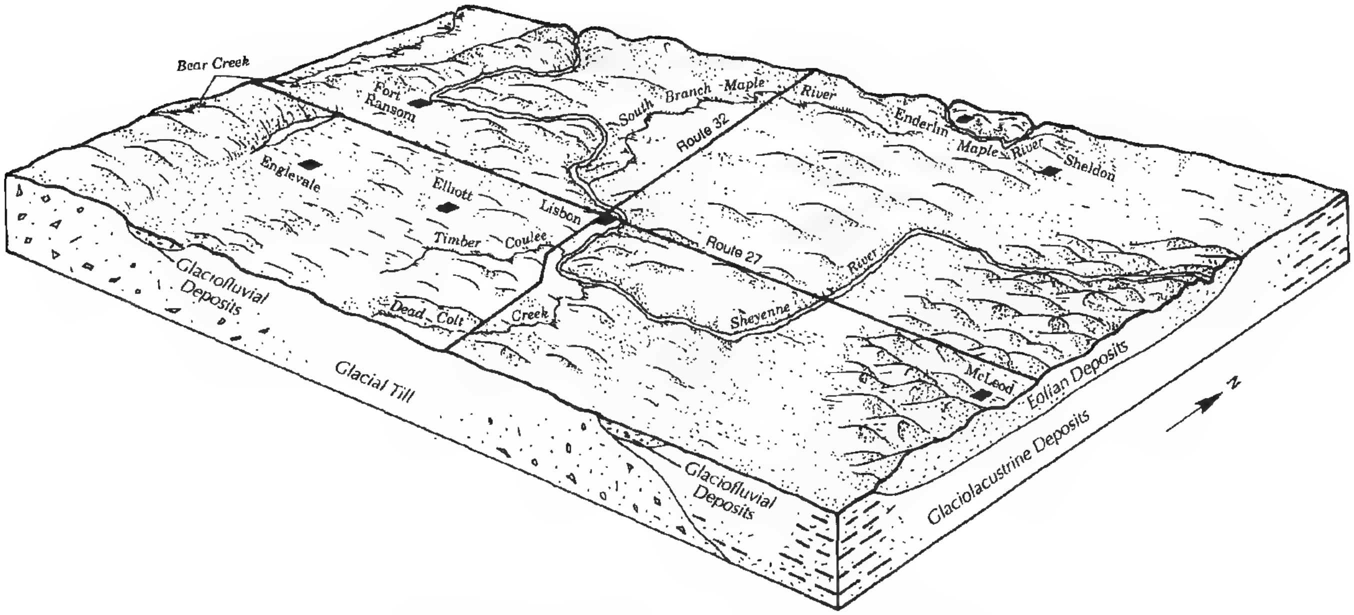


Figure 8. Physiographic features of Ransom County, North Dakota.

Order. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in sol. An example is Mollisol.

Suborder. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Boroll (Bor, meaning cool, plus oll, from Mollisol).

Great Group. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haploboroll (Hapl, meaning minimal horizonation, plus boroll, the suborder of the Mollisols that has a frigid temperature regime).

Subgroup. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective Udic identifies the subgroup that has a udic moisture regime. An example is Udic Haploborolls.

Family. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, superactive Udic Haploborolls.

Series. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series. An example is the Barnes soil series.

Table 5.-Classification of the Soils

Soil name	Family or higher taxonomic class
[1]Aberdeen	Fine, smectitic Glossic Udic Natriborolls
Arveson	Coarse-loamy, mixed, superactive, frigid Typic Calciaquolls
Arvilla	Sandy, mixed Udic Haploborolls
Aylmer	Mixed, frigid Aquic Udipsamments
Bantry	Mixed, frigid Typic Psammaquents
Barnes	Fine-loamy, mixed, superactive Udic Haploborolls
Bearden	Fine-silty, mixed, superactive, frigid Aeric Calciaquolls
[1]Borup	Coarse-silty, mixed, superactive, frigid Typic Calciaquolls
Brantford	Fine-loamy over sandy or sandy-skeletal, mixed, superactive Udic Haploborolls
Buse	Fine-loamy, mixed, superactive Udic Calciborolls
Cathay	Fine-loamy, mixed, superactive Glossic Udic Natriborolls
[1]Cavour	Fine, smectitic Udic Natriboroll
[1]Claire	Mixed, frigid Typic Udipsamments
[1]Clontarf	Coarse-loamy, mixed, superactive Pachic Udic Haploborolls
Coe	Sandy-skeletal, mixed Udorthentic Haploborolls
Colvin	Fine-silty, mixed, superactive, frigid Typic Calciaquolls
[1]Cresbard	Fine, smectitic Glossic Udic Natriborolls
Darnen	Fine-loamy, mixed, superactive Pachic Udic Haploborolls
[1]Dickey	Sandy over loamy, mixed, superactive Udorthentic Haploborolls
Divide	Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Aeric Calciaquolls
[1]Easby	Fine-loamy, mixed, superactive, frigid Typic Calciaquolls
Eckman	Coarse-silty, mixed, superactive Udic Haploborolls
[1]Edgeley	Fine-loamy, mixed, superactive Udic Haploborolls
[1]Egeland	Coarse-loamy, mixed, superactive Udic Haploborolls
Embden	Coarse-loamy, mixed, superactive Pachic Udic Haploborolls
Exline	Fine, smectitic Leptic Natriborolls
Fairdale	Fine-loamy, mixed, superactive, calcareous, frigid Mollic Udifluvents
Falsen	Sandy, mixed Oxyaquic Haploborolls
[1]Fargo	Fine, smectitic, frigid Typic Epiaquerts
Fordville	Fine-loamy over sandy or sandy-skeletal, mixed, superactive Pachic Udic Haploborolls
[1]Forman	Fine-loamy, mixed, superactive Udic Argiborolls
[1]Fossum	Sandy, mixed, calcareous, frigid Typic Endoaquolls
Gardena	Coarse-silty, mixed, superactive Pachic Udic Haploborolls
Glyndon	Coarse-silty, mixed, superactive, frigid Aeric Calciaquolls
[1]Great Bend	Fine-silty, mixed, superactive Udic Haploborolls
Gwinner	Fine, smectitic Pachic Udertic Argiborolls
Hamar	Sandy, mixed, frigid Typic Endoaquolls
Hamerly	Fine-loamy, mixed, superactive, frigid Aeric Calciaquolls
Hecla	Sandy, mixed Aquic Haploborolls
Hegne	Fine, smectitic, frigid Typic Calciaquerts
Kranzburg	Fine-silty, mixed, superactive Udic Haploborolls
La Prairie	Fine-loamy, mixed, superactive Cumulic Udic Haploborolls
LaDelle	Fine-silty, mixed, superactive Cumulic Udic Haploborolls

Table 5.-Classification of the Soils--(continued)

Soil name	Family or higher taxonomic class
Lamoure	Fine-silty, mixed, superactive, calcareous, frigid Cumulic Endoaquolls
[1]Langhei	Fine-loamy, mixed, superactive, frigid Typic Eutrochrepts
[1]Lankin	Fine-loamy, mixed, superactive Pachic Udic Haploborolls
Larson	Fine-loamy, mixed, superactive Udic Natriborolls
Lemert	Coarse-loamy, mixed, superactive Leptic Natriborolls
Letcher	Coarse-loamy, mixed, superactive Udic Natriborolls
Lismore	Fine-loamy, mixed Pachic Udic Haploborolls
[1]Lohnes	Sandy, mixed Udorthentic Haploborolls
Maddock	Sandy, mixed Udorthentic Haploborolls
Marysland	Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Typic Calciaquolls
[1]Minnewaukan	Mixed, frigid Typic Psammaquents
Nutley	Fine, smectitic, frigid Chromic Hapluderts
Overly	Fine-silty, mixed, superactive Pachic Udic Haploborolls
Parnell	Fine, smectitic, frigid Vertic Argiaquolls
Peever	Fine, smectitic Udic Argiborolls
[1]Perella	Fine-silty, mixed, superactive, frigid Typic Endoaquolls
Rauville	Fine-silty, mixed, superactive, calcareous, frigid Cumulic Endoaquolls
Renshaw	Fine-loamy over sandy or sandy-skeletal, mixed, superactive Udic Haploborolls
Rifle	Euic Typic Borohemists
Rosewood	Sandy, mixed, frigid Typic Calciaquolls
[1]Ryan	Fine, smectitic, frigid Typic Natraquerts
Serden	Mixed, frigid Typic Udipsamments
Sioux	Sandy-skeletal, mixed Udorthentic Haploborolls
Southam	Fine, smectitic, calcareous, frigid Cumulic Vertic Endoaquolls
[1]Spottswood	Fine-loamy over sandy or sandy-skeletal, mixed, superactive Pachic Udic Haploborolls
Stirum	Coarse-loamy, mixed, superactive, frigid Typic Natraquolls
Svea	Fine-loamy, mixed, superactive Pachic Udic Haploborolls
Swenoda	Coarse-loamy, mixed, superactive Pachic Udic Haploborolls
[1]Tiffany	Coarse-loamy, mixed, superactive, frigid Typic Endoaquolls
Tonka	Fine, smectitic, frigid Argiaquic Argialbolls
[1]Totten	Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Typic Natraquolls
Towner	Sandy over loamy, mixed, superactive Udorthentic Haploborolls
Ulen	Sandy, mixed, frigid Aeric Calciaquolls
Vallers	Fine-loamy, mixed, superactive, frigid Typic Calciaquolls
Vang	Fine-loamy over sandy or sandy-skeletal, mixed, superactive Pachic Udic Haploborolls
Venlo	Sandy, mixed, frigid Typic Endoaquolls
Wahpeton	Fine, smectitic, frigid Typic Hapluderts
Wyndmere	Coarse-loamy, mixed, superactive, frigid Aeric Calciaquolls
Zell	Coarse-silty, mixed, superactive Udic Calciborolls

Occurs as minor component only

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetical order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (Soil Survey Staff, 1993). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (USDA-SCS, 1975) and Keys to Soil Taxonomy (Soil Survey Staff, 1996a). Unless otherwise stated, colors in the descriptions are for moist soil and effervescence refers to disseminated lime throughout the horizon. Following the pedon description is the range of important characteristics of the soil series.

Aberdeen Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope: 0 to 2 percent
Notes: These soils are sodic.

Taxonomic class: Fine, smectitic Glossic Udic Natriborolls

Typical pedon:
Aberdeen silty clay loam, 580 feet west and 93 feet south of the northeast corner of sec. 9, T. 122 N., R. 63 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

BE—8 to 11 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; gray (10YR 6/1) dry silt coatings on faces of peds; weak medium subangular blocky structure parting to weak thin platy; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

Btn1—11 to 18 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; moderate medium prismatic structure parting to moderate fine blocky; hard, firm, sticky and plastic; shiny films on faces of peds; neutral; clear wavy boundary.

Btn2—18 to 26 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; moderate medium prismatic structure parting to moderate medium and fine blocky; hard, firm, sticky and plastic; shiny films on faces of peds; neutral; clear wavy boundary.

Bkz1—26 to 31 inches; grayish brown (2.5Y 5/2) silty clay loam, light gray (2.5Y 7/2) dry; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; common fine nests of gypsum and other salts; common very fine accumulations of lime; strong effervescence; slightly alkaline; clear wavy boundary.

Bkz2—31 to 38 inches; dark grayish brown (2.5Y 4/2) silty clay loam, light brownish gray (2.5Y 6/2) dry; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; common fine nests of gypsum and other salts; common very fine accumulations of lime; strong effervescence; slightly alkaline; gradual wavy boundary.

C1—38 to 51 inches; grayish brown (2.5Y 5/2) silt loam, light gray (2.5Y 7/2) dry; few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations and few fine distinct gray (10YR 5/1) redoximorphic depletions; massive; hard, friable, slightly sticky and slightly plastic; few fine threads and nests of gypsum and other salts; slight effervescence; slightly alkaline; gradual wavy boundary.

C2—51 to 60 inches; light olive brown (2.5Y 5/4) silt loam, laminated with thin layers of silty clay and

very fine sandy loam, pale yellow (2.5Y 7/4) dry; common fine prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) redoximorphic concentrations and gray (10YR 5/1) redoximorphic depletions; massive; laminations 1 to 3 mm thick; slightly hard, friable, slightly sticky and slightly plastic; slight effervescence; slightly alkaline.

Range in Characteristics

Depth to lime: 16 to 40 inches
Notes: Some pedons have an E or B/E horizon.

Ap horizon:
Value: 2 or 3, 3 or 4 dry
Texture: silty clay loam or silt loam

BE horizon:
Value: 3 or 4, 4 or 5 dry
Chroma: 1 or 2

Btn horizon:
Hue: 10YR or 2.5Y
Value: 2 to 4, 3 to 5 dry
Chroma: 1 to 3
Texture: silty clay, silty clay loam, or clay

Bkz horizon:
Hue: 2.5Y or 5Y
Value: 3 to 5, 5 to 7 dry
Chroma: 1 to 4
Texture: silty clay loam, silty clay, or silt loam

C horizon:
Hue: 2.5Y or 5Y
Value: 4 to 6, 5 to 8 dry
Texture: silt loam or silty clay loam

Arveson Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderately rapid
Landform: Delta plains and outwash plains
Parent material: Glaciofluvial deposits
Slope: 0 to 1 percent
Notes: These soils are highly calcareous.

Taxonomic class: Coarse-loamy, mixed, superactive, frigid Typic Calciaquolls

Typical pedon:
Arveson loam, 2,570 feet east and 400 feet north of the southwest corner of sec. 36, T. 133 N., R. 58 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; weak medium subangular blocky structure parting to weak fine granular; hard, friable, slightly sticky and slightly plastic; few fine roots; slight effervescence; moderately alkaline; abrupt smooth boundary.

Bk1—7 to 17 inches; very dark gray (10YR 3/1) loam, gray (10YR 6/1) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; violent effervescence; moderately alkaline; gradual wavy boundary.

Bk2—17 to 21 inches; very dark gray (10YR 3/1) loam, gray (10YR 6/1) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; clear wavy boundary.

Bkg—21 to 31 inches; gray (5Y 5/1) fine sandy loam, white (5Y 8/1) dry; few fine faint light gray (5Y 7/2) redoximorphic depletions; weak medium granular structure; slightly hard, very friable, slightly sticky and nonplastic; common fine irregularly shaped masses of lime; strong effervescence; moderately alkaline; clear wavy boundary.

Cg—31 to 60 inches; light olive gray (5Y 6/2) fine sand, pale yellow (5Y 7/3) dry; common fine faint gray (5Y 5/1) redoximorphic depletions, and many medium prominent olive yellow (2.5Y 6/6) and few fine prominent black (10YR 2/1) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; very slight effervescence; slightly alkaline; gradual wavy boundary.

Range in Characteristics

Mollic epipedon thickness: 7 to 24 inches

Ap horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 2 or 3

Bk horizon:
Value: 3 to 7
Texture: fine sandy loam, sandy clay loam, or loam

Cg horizon:
Hue: 2.5Y or 5Y
Value: 4 to 6
Chroma: 1 or 2

Texture: fine sand, loamy sand, loamy fine sand, sandy loam, or fine sandy loam
Notes: It does not have redoximorphic features in some pedons.

Arvilla Series

Depth class: Very deep
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid over very rapid
Landform: Outwash plains and terraces
Parent material: Glaciofluvial deposits
Slope: 0 to 6 percent

Taxonomic class: Sandy, mixed Udic Haploborolls

Typical pedon:
Arvilla sandy loam, 0 to 6 percent slopes, 550 feet east and 720 feet south of the northwest corner of sec. 10, T. 133 N., R. 54 W.

Ap—0 to 8 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; common fine and many very fine roots; neutral; abrupt smooth boundary.

Bw—8 to 15 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak medium prismatic structure parting to weak medium subangular blocky; soft, very friable, slightly sticky and nonplastic; many very fine and few fine roots; neutral; slightly alkaline; abrupt wavy boundary.

C1—15 to 22 inches; very dark grayish brown (10YR 3/2) gravelly sand, grayish brown (10YR 5/2) dry; single grain; loose; nonsticky and nonplastic; few very fine roots; about 15 percent gravel; slight effervescence; slightly alkaline; abrupt wavy boundary.

C2—22 to 60 inches; very dark grayish brown (10YR 3/2) very gravelly sand, light brownish gray (10YR 6/2) dry; single grain; loose; nonsticky and nonplastic; about 40 percent gravel; strong effervescence; slightly alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 16 inches
Depth to sand and gravel: 14 to 25 inches

Ap horizon:
Value: 2 or 3, 3 or 4 dry

Bw horizon:
Value: 2 to 4, 3 to 5 dry
Chroma: 1 to 3

2C horizon:
Notes: It has more than 15 percent gravel with an average of 20 to 35 percent gravel.

Aylmer Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Rapid
Landform: Delta plains
Parent material: Eolian deposits
Slope: 0 to 6 percent

Taxonomic class: Mixed, frigid Aquic Udipsamments

Typical pedon:
Aylmer fine sand, in an area of Aylmer-Rosewood-Serden complex, 0 to 9 percent slopes, 2,210 feet north and 1,450 feet west of the southeast corner of sec. 1, T. 133 N., R. 53 W.

A—0 to 7 inches; black (10YR 2/1) fine sand, dark gray (10YR 4/1) dry; single grain; loose; nonsticky and nonplastic; few fine and many very fine roots; neutral; clear wavy boundary.

C1—7 to 26 inches; dark brown (10YR 4/3) sand, brown (10YR 5/3) dry; single grain; loose; nonsticky and nonplastic; common very fine roots; neutral; gradual wavy boundary.

C2—26 to 38 inches; dark grayish brown (10YR 4/2) fine sand, grayish brown (10YR 5/2) dry; many fine distinct dark yellowish brown (10YR 4/6) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; few fine roots; neutral; clear wavy boundary.

Ab—38 to 45 inches; very dark grayish brown (10YR 3/2) fine sand, dark grayish brown (10YR 4/2) dry; common fine distinct dark yellowish brown (10YR 4/6) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; few fine roots; neutral; clear wavy boundary.

C3—45 to 60 inches; dark brown (10YR 4/3) fine sand, brown (10YR 5/3) dry; many medium distinct yellowish brown (10YR 5/6) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; neutral.

Range in Characteristics

A horizon:
Value: 2 to 4, 3 to 5 dry

C horizon:
Hue: 10YR or 2.5Y
Value: 4 to 6, 5 to 7 dry
Chroma: 1 to 4

Bantry Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Rapid
Landform: Delta plains
Parent material: Eolian deposits
Slope: 0 to 1 percent

Taxonomic class: Mixed, frigid Typic Psammaquents

Typical pedon:
Bantry fine sand, in an area of Aylmer-Bantry fine sands, 0 to 6 percent slopes, 1,730 feet west and 1,320 feet south of the northeast corner of sec. 2, T. 134 N., R. 54 W.

A—0 to 5 inches; very dark brown (10YR 2/2) fine sand, very dark grayish brown (10YR 3/2) dry; single grain; loose; nonsticky and nonplastic; few fine and many very fine roots; neutral; clear wavy boundary.

C1—5 to 21 inches; dark grayish brown (10YR 4/2) fine sand, grayish brown (10YR 5/2) dry; common fine distinct dark yellowish brown (10YR 4/6) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; few fine and many very fine roots; neutral; clear wavy boundary.

C2—21 to 60 inches; light olive brown (2.5Y 5/3) fine sand, light yellowish brown (2.5Y 6/3) dry; common fine prominent brownish yellow (10YR 6/6) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; common very fine roots; very slight effervescence below 45 inches; slightly alkaline.

Range in Characteristics

Notes: Redoximorphic features are at a depth of less than 20 inches. Some pedons have an Ab horizon.

A horizon:
Value: 2 or 3, 3 to 5 dry
Chroma: 1 or 2

C horizon:
Value: 3 to 5, 4 to 7 dry
Chroma: 2 to 4
Texture: fine sand or sand
Notes: It does not have lime in the lower part in some pedons.

Barnes Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately slow
Landform: Till plains
Parent material: Glacial till
Slope: 0 to 25 percent

Taxonomic class: Fine-loamy, mixed, superactive Udic Haploborolls

Typical pedon:
Barnes loam, in an area of Barnes-Svea loams, 0 to 3 percent slopes, 1,820 feet south and 190 feet east of the northwest corner of sec. 5, T. 134 N., R. 57 W.

Ap—0 to 7 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; about 2 percent gravel; slightly alkaline; abrupt smooth boundary.

Bw—7 to 15 inches; dark brown (10YR 4/3) loam, brown (10YR 5/3) dry; moderate medium prismatic structure parting to moderate medium angular blocky; hard, firm, slightly sticky and slightly plastic; common fine and very fine roots; few fine pores; about 3 percent gravel; slightly alkaline; clear wavy boundary.

Bk—15 to 28 inches; light olive brown (2.5Y 5/4) loam, light yellowish brown (2.5Y 6/4) dry; few fine prominent strong brown (7.5YR 5/6) relict redoximorphic concentrations; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; few fine pores; about 3 percent gravel; few fine irregularly shaped masses of lime; violent effervescence; moderately alkaline; gradual wavy boundary.

C—28 to 60 inches; olive brown (2.5Y 4/4) loam, light yellowish brown (2.5Y 6/4) dry; few fine prominent strong brown (7.5YR 5/6) relict redoximorphic concentrations; massive; hard, friable, slightly

sticky and slightly plastic; about 3 percent gravel; few medium irregularly shaped masses of lime; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 15 inches

Ap horizon:
Value: 2 or 3, 3 or 4 dry

Bw horizon:
Hue: 10YR or 2.5Y
Value: 2 to 5, 3 to 6 dry
Chroma: 2 to 4
Texture: loam or clay loam

Bk horizon:
Hue: 2.5Y or 10YR
Value: 4 to 6, 5 to 7 dry
Chroma: 2 to 4
Texture: loam or clay loam

C horizon:
Value: 4 to 6, 5 to 7 dry
Chroma: 2 to 4
Texture: loam or clay loam

Bearden Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderately slow over rapid
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope: 0 to 1 percent
Notes: These soils are highly calcareous.

Taxonomic class: Fine-silty, mixed, superactive, frigid Aeric Calciaquolls

Typical pedon:
Bearden silt loam, 560 feet east and 240 feet south of the northwest corner of sec. 28, T. 133 N., R. 53 W.

Ap—0 to 9 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure parting to moderate fine granular; slightly hard, very friable, slightly sticky and slightly plastic; common fine and many very fine roots; slight effervescence; slightly alkaline; abrupt smooth boundary.

Bk1—9 to 23 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak medium subangular blocky structure; slightly hard, very friable; slightly sticky and slightly plastic; common very fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

Bk2—23 to 34 inches; light olive brown (2.5Y 5/4) silt loam, light yellowish brown (2.5Y 6/4) dry; few fine prominent gray (5Y 5/1) redoximorphic depletions, and common medium distinct brown (10YR 5/3) and few fine prominent very dark brown (10YR 2/2) redoximorphic concentrations; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; strong effervescence; moderately alkaline; gradual wavy boundary.

Bk3—34 to 43 inches; olive gray (5Y 5/2) silty clay loam, light gray (5Y 7/2) dry; common medium prominent dark yellowish brown (10YR 4/4) redoximorphic concentrations; moderate medium subangular blocky structure parting to weak fine subangular blocky; hard, friable, sticky and plastic; few very fine roots; strong effervescence; moderately alkaline; abrupt wavy boundary.

2C—43 to 60 inches; light olive gray (5Y 6/2) fine sand, light gray (5Y 7/2) dry; many medium prominent light yellowish brown (2.5Y 6/4) and common fine prominent black (10YR 2/1) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; slight effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 20 inches
Depth to sandy material: 40 to 60 inches

Ap horizon:
Hue: 10YR, 2.5Y, or neutral
Value: 3 to 5 dry
Chroma: 0 to 2

Bk horizon:
Value: 3 to 5, 5 to 7 dry
Chroma: 1 to 4
Notes: It has few to common, faint to prominent redoximorphic features. It has gypsum in some pedons.

C horizon:
Hue: 2.5Y or 5Y
Value: 4 to 6, 5 to 7 dry
Chroma: 2 to 4

Borup Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope: 0 to 3 percent
Notes: These soils are highly calcareous.

Taxonomic class: Coarse-silty, mixed, superactive, frigid Typic Calciaquolls

Typical pedon:
Borup very fine sandy loam, 720 feet north and 210 feet west of the southeast corner of sec. 2, T. 145 N., R. 46 W.

Ap—0 to 9 inches; black (10YR 2/1) very fine sandy loam; dark gray (10YR 4/1) dry; moderate fine granular structure; very friable; many roots; strong effervescence; slightly alkaline; abrupt smooth boundary.

Ak—9 to 14 inches; very dark gray (10YR 3/1) sandy clay loam; weak fine subangular blocky structure; very friable; many roots; strong effervescence; disseminated lime; slightly alkaline; clear wavy boundary.

Bkg1—14 to 21 inches; dark gray (5Y 4/1) sandy clay loam; weak fine granular structure; very friable; few roots; strong effervescence; disseminated lime; slightly alkaline; abrupt wavy boundary.

Bkg2—21 to 26 inches; olive gray (5Y 4/2) very fine sandy loam; weak medium subangular blocky structure; very friable; strong effervescence; disseminated lime; slightly alkaline; gradual wavy boundary.

Cg—26 to 60 inches; light olive gray (5Y 6/2) loamy very fine sand; common medium prominent olive yellow (2.5Y 6/6) and yellowish brown (10YR 5/8) redoximorphic concentrations; massive; very friable; slight effervescence; slightly alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 20 inches
10 to 40 inch particle-size control section: Calcium carbonate equivalent of 15 to 40 percent
Notes: Some pedons have a 2C horizon of till, clayey glaciolacustrine deposits, or sandy material at depths of 40 to 60 inches.

Ap horizon:
Hue: 10YR, 2.5Y, 5Y, or neutral
Value: 2 or 3
Chroma: 0 or 1
Texture: very fine sandy loam, loam, silt loam, or silty clay loam

Bkg horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6
Texture: loamy very fine sand, very fine sandy loam, sandy clay loam, loam, or silt loam

Cg horizon:
Hue: 10YR, 2.5Y, 5Y, or neutral
Value: 4 to 6
Chroma: 0 to 3
Texture: very fine sand, loamy very fine sand, very fine sandy loam, loam, or silt loam

Brantford Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate over very rapid
Landform: Outwash plains
Parent material: Glaciofluvial deposits
Slope: 1 to 3 percent

Taxonomic class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive Udic Haploborolls

Typical pedon:
Brantford loam, in an area of Brantford-Coe loams, 1 to 6 percent slopes, 1,400 feet east and 730 feet north of the southwest corner of sec. 20, T. 135 N., R. 58 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak medium granular; soft, very friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

Bw—9 to 16 inches; dark brown (10YR 4/3) loam, brown (10YR 5/3) dry; moderate medium prismatic structure parting to moderate medium subangular blocky; slight hard, friable; slightly sticky and slightly plastic; neutral; clear wavy boundary.

C1—16 to 23 inches; dark grayish brown (2.5Y 4/2) gravelly sand, light brownish gray (2.5Y 6/2) dry;

single grain; loose; nonsticky and nonplastic; about 25 percent shale gravel; about 10 percent granitic gravel; moderately alkaline; gradual wavy boundary.

C2—23 to 60 inches; olive brown (2.5Y 4/4) very gravelly sand, light yellowish brown (2.5Y 6/4) dry; single grain; loose; nonsticky and nonplastic; about 20 percent shale gravel; about 25 percent granitic gravel; slight effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 16 inches
Depth to sand and gravel: 14 to 20 inches

Ap horizon:
Value: 2 or 3, 3 or 4 dry

Bw horizon:
Hue: 10YR or 2.5Y
Value: 3 or 4, 3 to 5 dry
Chroma: 1 to 3

C horizon:
Texture: gravelly coarse sand, gravelly sand, very gravelly sand, or very gravelly coarse sand
Notes: It has 20 to 50 percent shale gravel.

Buse Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately slow
Landform: Till plains and valleys
Parent material: Glacial till
Slope: 3 to 50 percent
Notes: These soils are highly calcareous.

Taxonomic class: Fine-loamy, mixed, superactive Udic Calciborolls

Typical pedon:
Buse loam, in an area of Barnes-Buse loams, 6 to 9 percent slopes, 690 feet north and 400 feet west of the southeast corner of sec. 17, T. 134 N., R. 57 W.

Ap—0 to 6 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and common fine roots; about 2 percent gravel; slight effervescence; moderately alkaline; abrupt smooth boundary.

Bk—6 to 17 inches; olive brown (2.5Y 4/4) loam, light yellowish brown (2.5Y 6/4) dry; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; few fine and very fine roots; about 2 percent gravel; violent effervescence; moderately alkaline; gradual wavy boundary.

C—17 to 60 inches; light olive brown (2.5Y 5/4) loam, pale yellow (2.5Y 7/4) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; about 5 percent gravel; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 10 inches
Percent rock fragments: 2 to 10 percent

A horizon:
Value: 2 or 3, 3 to 5 dry
Notes: It is partially or completely free of lime in some uncultivated pedons.

Bk horizon:
Hue: 10YR or 2.5Y
Value: 4 to 6, 4 to 7 dry
Chroma: 2 to 4

C horizon:
Hue: 2.5Y or 5Y
Value: 4 to 6, 4 to 7 dry
Chroma: 2 to 4
Notes: It has a few relict redoximorphic features in some pedons.

Cathay Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow
Landform: Till plains
Parent material: Glacial till
Slope: 0 to 2 percent
Notes: These soils are sodic.

Taxonomic class: Fine-loamy, mixed, superactive Glossic Udic Natriborolls

Typical pedon:
Cathay loam, in an area of Cathay-Larson loams, bouldery, 1,500 feet west and 280 feet south of the northeast corner of sec. 7, T. 135 N., R. 58 W.

A—0 to 9 inches; black (10YR 2/1) bouldery loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular;

slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; slightly acid; clear smooth boundary.

BE—9 to 14 inches; very dark gray (10YR 3/1) bouldery loam, gray (10YR 5/1) dry; moderate medium subangular blocky structure parting to weak medium platy; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; slightly acid; clear irregular boundary.

Btn—14 to 21 inches; very dark gray (10YR 3/1) bouldery clay loam, dark gray (10YR 4/1) dry; moderate medium prismatic structure parting to moderate medium angular blocky; hard, firm, sticky and plastic; clean silt and sand grains on tops and sides of prisms; few faint clay films on faces of peds; neutral; clear wavy boundary.

By—21 to 38 inches; dark grayish brown (2.5Y 4/2) bouldery loam, light brownish gray (2.5Y 6/2) dry; many medium distinct light olive brown (2.5Y 5/4) and few fine distinct very dark brown (10YR 2/2) redoximorphic concentrations; moderate medium subangular blocky structure; slightly hard, and firm, slightly sticky and slightly plastic; few fine irregular nests of gypsum; moderately alkaline; gradual wavy boundary.

Bky—38 to 60 inches; dark grayish brown (2.5Y 4/2) bouldery clay loam, light brownish gray (2.5Y 6/2) dry; many medium prominent light olive brown (2.5Y 5/6) redoximorphic concentrations; massive; hard, firm, sticky and plastic; common gypsum crystals; strong effervescence; moderately alkaline.

Range in Characteristics

Depth to gypsum or other salts: 16 to 24 inches
Notes: Some pedons have an E horizon. Some pedons have a C horizon.

A horizon:
Value: 2 or 3, 3 or 4 dry

BE horizon:
Hue: 10YR or 2.5Y
Value: 3 or 4, 4 to 6 dry
Chroma: 1 or 2
Notes: Some pedons do not have a BE horizon.

Btn horizon:
Hue: 10YR or 2.5Y
Value: 3 or 4, 3 to 5 dry
Chroma: 1 to 4

By and Bky horizons:
Value: 4 to 6, 5 to 7 dry
Chroma: 2 to 4
Notes: Some pedons do not have a By horizon.

Cavour Series

Depth Class: Very deep
Drainage Class: Moderately well drained
Permeability: Slow
Landform: Till plains
Parent material: Glacial till
Slope: 0 to 3 percent
Notes: These soils are sodic.

Taxonomic class: Fine, smectitic Udic Natriborolls

Typical Pedon:
Cavour loam, 1,525 feet west and 1,170 feet north of the southeast corner of sec. 33, T. 144 N., R. 61 W.

Ap—0 to 6 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and common fine roots; about 4 percent gravel; neutral; abrupt smooth boundary.

A—6 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak coarse platy structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine and common fine roots; about 2 percent gravel; neutral; abrupt wavy boundary.

E—8 to 10 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate coarse platy structure; slightly hard, very friable; slightly sticky and slightly plastic; common very fine and few fine roots; about 1 percent gravel; neutral; clear wavy boundary.

Btn—10 to 20 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; moderate coarse columnar structure parting to strong coarse angular blocky; very hard, firm, very sticky and very plastic; common very fine and few fine compressed roots on ped faces; many distinct clay films on faces of peds and in pores; very dark grayish brown (10YR 3/2) uncoated sand and silt grains on top of columns;

about 2 percent gravel; slightly alkaline; gradual wavy boundary.

Bkyz—20 to 27 inches; dark gray (10YR 4/1) loam, gray (10YR 5/1) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; about 2 percent gravel; common fine salt and gypsum crystals; strong effervescence; moderately alkaline; gradual wavy boundary.

Bk—27 to 39 inches; grayish brown (2.5Y 5/2) loam, light gray (2.5Y 7/2) dry; common fine prominent yellow (2.5Y 7/6) redoximorphic concentrations; massive; slightly hard, friable, slightly sticky and slightly plastic; about 10 percent gravel; common fine masses of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C—39 to 60 inches; light olive brown (2.5Y 5/4) loam, light yellowish brown (2.5Y 6/4) dry; common fine distinct light gray (2.5Y 7/2) redoximorphic depletions and yellow (2.5Y 7/6) redoximorphic concentrations; massive; slightly hard, friable, slightly sticky and slightly plastic; about 14 percent gravel; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 9 to 30 inches
Depth to gypsum or other salts: 16 to 40 inches

A horizon:
Value: 2 to 4, 3 to 6 dry

E horizon:
Value: 2 to 4, 3 to 6 dry
Chroma: 1 or 2

Btn horizon:
Value: 2 to 4, 3 to 5 dry
Chroma: 1 to 3
Texture: clay loam, silty clay, or silty clay loam

Bk horizon:
Texture: loam or clay loam

C horizon:
Value: 4 or 5, 5 to 7 dry
Chroma: 2 to 4

Claire Series

Depth class: Very deep
Drainage class: Excessively drained
Permeability: Rapid
Landform: Outwash plains
Parent material: Glaciofluvial deposits
Slope: 0 to 25 percent

Taxonomic class: Mixed, frigid Typic Udipsamments

Typical pedon:
Claire loamy coarse sand, 2,540 feet east and 670 feet north of the southwest corner of sec. 2, T. 150 N., R. 63 W.

Ap—0 to 8 inches; black (10YR 2/1) loamy coarse sand, dark gray (10YR 4/1) dry; very weak fine subangular blocky structure parting to single grain; loose; common roots; neutral; abrupt smooth boundary.

AC—8 to 14 inches; very dark grayish brown (10YR 3/2) coarse sand, dark grayish brown (10YR 4/2) dry; weak very coarse prismatic structure parting to single grain; loose; few roots; neutral; clear wavy boundary.

C1—14 to 19 inches; very dark grayish brown (10YR 3/2) coarse sand, dark grayish brown (10YR 4/2) dry; single grain; few roots; slightly alkaline; clear wavy boundary.

C2—19 to 48 inches; dark grayish brown (10YR 4/2) coarse sand, grayish brown (10YR 5/2) dry; single grain; slightly alkaline; abrupt smooth boundary.

C3—48 to 60 inches; dark grayish brown (2.5Y 4/2) fine sand, light gray (10YR 7/1) dry; common medium dark reddish gray (5YR 4/2) redoximorphic concentrations; single grain; slight effervescence; moderately alkaline.

Range in Characteristics

10 to 40 inch particle-size control section: Coarse sand, sand, or loamy coarse sand
Notes: Some pedons have Ab horizons.

Ap horizon:
Value: 2 to 4, 4 to 6 dry
Chroma: 1 or 2
Texture: loamy coarse sand or loamy sand

AC horizon:
Value: 3 or 4, 4 to 6 dry
Texture: loamy coarse sand, loamy sand, or coarse sand

C horizon:
Value: 3 to 5
Chroma: 1 to 6

Clontarf Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid over rapid
Landform: Outwash plains
Parent material: Glaciofluvial deposits
Slope: 0 to 6 percent

Taxonomic class: Coarse-loamy, mixed superactive Pachic Udic Haploborolls

Typical pedon:
Clontarf sandy loam, 600 feet south and 150 feet west of the northeast corner of sec. 25, T. 122 N., R. 41 W.

Ap—0 to 7 inches; black (10YR 2/1) sandy loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A—7 to 15 inches; black (10YR 2/1) sandy loam; dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

Bw1—15 to 22 inches; dark brown (10YR 3/3) sandy loam, very dark grayish brown (10YR 3/2) coatings on peds, grayish brown (10YR 5/2) crushed and dry; weak fine subangular blocky structure; friable; neutral; gradual wavy boundary.

Bw2—22 to 25 inches; olive brown (2.5Y 3/4) sandy loam; grayish brown (2.5Y 5/2) dry; common fine faint grayish brown (2.5Y 5/2) redoximorphic depletions and light olive brown (2.5Y 5/4) redoximorphic concentrations; weak fine subangular blocky structure; friable; neutral; clear wavy boundary.

2C1—25 to 40 inches; olive brown (2.5Y 4/4) sand; common fine distinct grayish brown (2.5Y 5/2) redoximorphic depletions and yellowish brown (10YR 5/4) redoximorphic concentrations; single grain; loose; neutral; gradual wavy boundary.

2C2—40 to 60 inches; light olive brown (2.5Y 5/6) sand; few fine distinct yellowish brown (10YR 5/4) and pale brown (10YR 6/3) redoximorphic concentrations; single grain; loose; neutral.

Range in Characteristics

Mollic epipedon thickness: 16 to 34 inches
Depth to lime: 40 to more than 60 inches
Depth to sand and gravel: 20 to 36 inches
Notes: Some pedons have a sandy 2Bw horizon up to 10 inches thick.

A horizon:
Value: 2 or 3
Texture: sandy loam, fine sandy loam, or loam

Bw horizon:
Value: 3 or 4
Chroma: 2 to 4
Texture: sandy loam, fine sandy loam, or loam

2C horizon:
Hue: 10YR or 2.5Y
Value: 4 to 6
Chroma: 2 to 6
Texture: sand, fine sand, loamy sand, or loamy fine sand
Notes: It has up to 15 percent gravel.

Coe Series

Depth class: Very deep
Drainage class: Excessively drained
Permeability: Very rapid
Landform: Outwash plains
Parent material: Glaciofluvial deposits
Slope: 3 to 6 percent

Taxonomic class: Sandy-skeletal, mixed Udorthentic Haploborolls

Typical pedon:
Coe loam, in an area of Brantford-Coe loams, 1 to 6 percent slopes, 2,500 feet west and 900 feet north of the southeast corner of sec. 25, T. 134 N., R. 58 W.

Ap—0 to 7 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure parting to moderate medium granular; hard, friable, slightly sticky and nonplastic; few fine roots; about 2 percent by volume shale gravel; about 10 percent by volume granitic gravel; slightly alkaline; abrupt smooth boundary.

C1—7 to 32 inches; dark grayish brown (2.5Y 4/2) very gravelly sand, grayish brown (2.5Y 5/2) dry; single grain; loose; nonsticky and nonplastic; about 30 percent by volume shale gravel; about 5 percent by volume granitic gravel; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—32 to 60 inches; dark grayish brown (2.5Y 4/2) extremely gravelly sand, light brownish gray

(2.5Y 6/2) dry; single grain; loose; nonsticky and nonplastic; about 50 percent by volume shale gravel; about 15 percent by volume granitic gravel; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 12 inches
Depth to sand and gravel: 6 to 14 inches
Notes: The sand and gravel contain more than 20 percent shale. Some pedons have an AC horizon.

Ap horizon:
Value: 2 or 3, 3 to 5 dry

C horizon:
Hue: 2.5Y, 5Y, or neutral
Value: 4 to 6, 4 to 7 dry
Chroma: 0 to 3
Texture: gravelly, very gravelly or extremely gravelly coarse sand, sand, or loamy coarse sand

Colvin Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderately slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope: 0 to 1 percent
Notes: These soils are highly calcareous.

Taxonomic class: Fine-silty, mixed, superactive, frigid Typic Calciaquolls

Typical pedon:
Colvin silt loam, 1,120 feet east and 150 feet north of the southwest corner of sec. 2, T. 133 N., R. 54 W.

A—0 to 6 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; slight effervescence; slightly alkaline; clear smooth boundary.

ABk—6 to 12 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; strong effervescence; slightly alkaline; clear wavy boundary.

Bkg1—12 to 23 inches; gray (5Y 5/1) silty clay loam, light gray (5Y 6/1) dry; weak coarse subangular blocky structure; hard, friable, sticky and plastic; many very fine roots; common medium irregularly shaped masses of lime; violent effervescence; moderately alkaline; gradual wavy boundary.

Bkg2—23 to 36 inches; olive gray (5Y 5/2) silty clay loam, light gray (5Y 7/2) dry; few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; weak medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; few large rounded masses of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg—36 to 60 inches; light olive gray (5Y 6/2) silty clay loam, light gray (5Y 7/2) dry; common medium prominent olive yellow (2.5Y 6/6) and few fine prominent very dark brown (10YR 2/2) redoximorphic concentrations; massive; hard, firm, sticky and plastic; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 20 inches
Notes: Some pedons have fine sand below a depth of 40 inches.

A horizon:
Hue: 10YR, 2.5Y, or neutral
Value: 2 or 3, 3 or 4 dry

Bkg horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 3 to 5, 5 to 7 dry

Cg horizon:
Hue: 2.5Y or 5Y
Value: 4 to 6, 5 to 7 dry
Chroma: 2 to 4

Cresbard Series

Depth class: Very deep
Drainage class: Moderately well
Permeability: Slow
Landform: Till plains
Parent material: Glacial till
Slope: 0 to 6 percent
Notes: These soils are sodic.

Taxonomic class: Fine, smectitic Glossic Udic Natriborolls

Typical pedon:
Cresbard loam, 1,300 feet south and 120 feet west of the northeast corner of sec. 35, T. 115 N., R. 59 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots throughout; common very fine vesicular and few tubular pores; moderately acid; abrupt smooth boundary.

E—9 to 10 inches; very dark grayish brown (10YR 3/2) loam, light gray (10YR 6/1) dry; weak fine and medium platy structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine vesicular and tubular pores; slightly acid; clear smooth boundary.

E/B—10 to 14 inches; 60 percent very dark grayish brown (10YR 3/2) (E) and 40 percent black (10YR 2/1) (B) clay loam, light gray (10YR 6/1) (E) and dark gray (10YR 4/1) (B) dry; moderate medium prismatic structure parting to moderate very fine and fine blocky; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine tubular and common vesicular pores; slightly acid; clear smooth boundary.

Btn1—14 to 28 inches; black (10YR 2/1) silty clay, dark gray (10YR 4/1) dry; moderate medium prismatic structure parting to strong medium blocky; very hard, firm, very sticky and very plastic; common very fine and fine roots; common very fine tubular pores; neutral; gradual wavy boundary.

Btn2—28 to 34 inches; dark grayish brown (2.5Y 4/2) silty clay, grayish brown (2.5Y 5/2) dry; moderate medium prismatic structure parting to strong medium blocky; extremely hard, firm, moderately sticky and moderately plastic; common very fine and fine roots throughout; common very fine tubular pores; common prominent dark gray (10YR 4/1) dry continuous clay films on vertical and horizontal faces of peds; about 1 percent gravel; neutral; clear wavy boundary.

Bk—34 to 55 inches; dark grayish brown (2.5Y 4/2) clay loam, grayish brown (2.5Y 5/2) dry; many coarse faint gray (10YR 5/1) dry redoximorphic depletions and few fine prominent yellowish brown (10YR 5/6) dry redoximorphic concentrations; moderate medium prismatic structure parting to weak very fine and fine subangular blocky; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine tubular pores; common medium irregular masses of lime; about 3 percent gravel; strong effervescence; slightly alkaline; gradual irregular boundary.

C—55 to 60 inches; grayish brown (2.5Y 5/2) clay loam, light brownish gray (2.5Y 6/2) dry; many medium distinct light gray (10YR 6/1) dry redoximorphic depletions and many fine prominent yellowish brown (10YR 5/6) dry redoximorphic concentrations; massive; hard, friable, slightly sticky and slightly plastic; many very fine vesicular and tubular pores; few fine rounded masses of lime; strong effervescence; about 2 percent gravel; slightly alkaline.

Range in Characteristics

Depth to lime: 15 to 40 inches

Ap horizon:
Value: 2 or 3, 3 or 4 dry
Texture: silt loam or loam

E horizon:
Value: 2 to 4, 5 or 6 dry
Texture: loam or silt loam

E/B horizon:
Hue: 10YR or 2.5Y
Value: E part - 2 to 4, 5 or 6 dry; B part - 2 to 4, 3 to 6 dry
Chroma: B part - 1 to 3
Texture: clay loam or silty clay loam

Btn horizon:
Value: 3 to 6 dry
Chroma: 1 to 3
Texture: silty clay, clay loam, or clay
Notes: It contains 35 to 50 percent clay and more than 15 percent fine sand or coarser sand.

Bk horizon:
Hue: 2.5Y or 5Y
Value: 4 to 6, 5 to 7 dry
Chroma: 2 to 4
Texture: clay loam, loam, or silt loam

C horizon:
Hue: 2.5Y or 5Y
Value: 4 to 6, 5 to 7 dry
Chroma: 2 to 4
Texture: clay loam, loam, or silt loam
Notes: It has nests of gypsum or other salts in some pedons.

Darnen Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate
Landform: Till plains
Parent material: Colluvium from glacial till
Slope: 3 to 6 percent

Taxonomic class: Fine-loamy, mixed, superactive Pachic Udic Haploborolls

Typical pedon:
Darnen loam, 3 to 6 percent slopes, 1,030 feet east and 750 feet south of the northwest corner of sec. 17, T. 136 N., R. 57 W.

Ap—0 to 6 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

A1—6 to 13 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; slightly hard, friable; slightly sticky and slightly plastic; neutral; clear wavy boundary.

A2—13 to 22 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; gradual wavy boundary.

Bw—22 to 31 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; about 1 percent gravel; neutral; gradual wavy boundary.

Bk1—31 to 37 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; about 3 percent gravel; common fine filaments and few fine rounded masses of lime; strong effervescence; moderately alkaline; clear wavy boundary.

Bk2—37 to 60 inches; dark brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; hard and firm; slightly sticky and slightly plastic; about 3 percent gravel; many fine irregularly shaped masses of lime; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 20 to 48 inches
Depth to lime: 20 to 60 inches
Depth to the Bk or C horizon: 30 to 60 inches
Notes: Redoximorphic features occur below a depth of 36 inches in some pedons. Some pedons have a loam or clay loam C horizon.

A horizon:
Value: 2 in the upper part, and 2 or 3 in the lower part

Bw horizon:
Hue: 10YR or 2.5Y
Value: 3 to 5
Chroma: 2 to 4
Texture: loam or clay loam

Bk horizon:
Notes: Some pedons do not have a Bk horizon.

Dickey Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Rapid over moderate
Landform: Till plains
Parent material: Eolian over glacial till
Slope: 1 to 25 percent

Taxonomic class: Sandy over loamy, mixed, superactive Udorthentic Haploborolls

Typical pedon:
Dickey loamy fine sand, 650 feet south and 100 feet west of the northeast corner of sec. 5, T. 153 N., R. 74 W.

A—0 to 12 inches; very dark gray (10YR 3/1) loamy fine sand, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; common fine roots throughout; slightly alkaline; clear wavy boundary.

Bw1—12 to 20 inches; brown (10YR 4/3) loamy fine sand, brown (10YR 5/3) dry; weak very coarse prismatic structure parting to weak fine and medium subangular blocky; soft, very friable, nonsticky and nonplastic; few fine roots throughout; neutral; clear wavy boundary.

Bw2—20 to 30 inches; brown (10YR 4/3) fine sand, brown (10YR 5/3) dry; single grain; nonsticky and nonplastic; few fine roots throughout; neutral; abrupt wavy boundary.

2Bk—30 to 42 inches; light olive brown (2.5Y 5/4) loam, light brownish gray (2.5Y 6/2) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common lime concretions throughout; violent effervescence throughout (HCl, unspecified); moderately alkaline; gradual wavy boundary.

2C—42 to 60 inches; olive brown (2.5Y 4/4) loam, light brownish gray (2.5Y 6/2) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; strong effervescence throughout (HCl, unspecified); moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 16 inches
Depth to glacial till: 20 to 40 inches
Notes: Some pedons have AC, BC, or C horizons above the 2C horizon. Some pedons have 2BC horizons.

A horizon:
Texture: loamy fine sand, loamy sand, fine sandy loam, or sandy loam

Bw horizon:
Texture: loamy fine sand, fine sand, or loamy sand

2C horizon:
Texture: loam, clay loam, silt loam, or silty clay
Notes: It contains up to 10 percent rock fragments. A thin stone, cobble, or gravel line is at the upper boundary of the 2C horizon in some pedons.

Divide Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderate over very rapid
Landform: Outwash plains
Parent material: Glaciofluvial deposits
Slope: 0 to 1 percent
Notes: These soils are highly calcareous.

Taxonomic class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Aeric Calciaquolls

Typical pedon:
Divide loam, 1,280 feet north and 2,560 feet east of the southwest corner of sec. 28, T. 136 N., R. 58 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; strong effervescence; moderately alkaline; abrupt smooth boundary.

Ak—8 to 12 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; few fine irregularly shaped masses of lime; strong effervescence; moderately alkaline; clear smooth boundary.

Bk1—12 to 20 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common medium irregularly shaped masses of lime; violent effervescence; moderately alkaline; gradual wavy boundary.

Bk2—20 to 29 inches; brown (10YR 5/3) loam, pale brown (10YR 6/3) dry; common medium distinct brownish yellow (10YR 6/6) redoximorphic concentrations; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; common medium irregularly shaped masses of lime; few medium nests of gypsum; strong effervescence; moderately alkaline; clear wavy boundary.

2C1—29 to 33 inches; brown (10YR 5/3) gravelly loamy sand, pale brown (10YR 6/3) dry; common fine distinct brownish yellow (10YR 6/6) redoximorphic concentrations; weak fine subangular blocky structure parting to single grain; loose; nonsticky and nonplastic; about 20 percent gravel; strong effervescence; moderately alkaline; gradual wavy boundary.

2C2—33 to 60 inches; olive brown (2.5Y 4/4) very gravelly sand, light yellowish brown (2.5Y 6/4) dry; common medium distinct olive yellow (2.5Y 6/6) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; about 35 percent gravel; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 20 inches
Depth to sand and gravel: 20 to 40 inches
Notes: Some pedons have an ABk horizon. Some pedons have up to 10 percent shale gravel.

A horizon:
Hue: 10YR or 2.5Y
Value: 3 to 5 dry

Bk horizon:
Hue: 10YR or 2.5Y
Value: 3 to 6, 5 to 8 dry
Chroma: 1 to 4

2C horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 5 to 7 dry
Chroma: 2 to 6
Texture: gravelly loamy sand, gravelly sand, very gravelly loamy sand, or very gravelly sand

Easby Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderately slow
Landform: Till plains
Parent material: Glacial till
Slope: 0 to 1 percent
Notes: These soils are saline.

Taxonomic class: Fine-loamy, mixed, superactive, frigid Typic Calciaquolls

Typical pedon:
Easby clay loam, 2,125 feet west and 525 feet south of the northeast corner of sec. 4, T. 160 N., R. 59 W.

Ap—0 to 7 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak fine and medium subangular blocky structure; very hard, friable, sticky and plastic; few fine roots; few fine masses of salt; slight effervescence; moderately alkaline; abrupt smooth boundary.

ABkyz—7 to 11 inches; dark gray (10YR 4/1) clay loam, gray (10YR 6/1) dry; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, sticky and slightly plastic; few very fine roots; few fine masses of salt and gypsum; strong effervescence; moderately alkaline; clear irregular boundary.

Bky—11 to 22 inches; light brownish gray (2.5Y 6/2) clay loam, light gray (2.5Y 7/2) dry; few fine prominent dark yellowish brown (10YR 4/6) and common medium prominent brownish yellow (10YR 6/6) redoximorphic concentrations; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, sticky and slightly plastic; about 2 percent gravel; common fine masses of gypsum; few fine masses of lime; violent effervescence; moderately alkaline; clear irregular boundary.

C1—22 to 30 inches; dark grayish brown (2.5Y 4/2) clay loam, light brownish gray (2.5Y 6/2) dry; common medium distinct light olive brown (2.5Y 5/4) and few medium prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations and gray (10YR 6/1) redoximorphic depletions; massive; slightly hard, friable, sticky and plastic; about 5 percent gravel; few fine masses of gypsum; few fine masses of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—30 to 43 inches; grayish brown (2.5Y 5/2) loam, light brownish gray (2.5Y 6/2) dry; few medium prominent dark brown (10YR 3/3), few fine prominent dark red (2.5YR 3/6) and many medium prominent dark brown (7.5YR 4/4) redoximorphic concentrations and common medium prominent gray (10YR 6/1) redoximorphic depletions; massive; slightly hard, friable, sticky and plastic; about 10 percent gravel; strong effervescence; moderately alkaline; gradual wavy boundary.

C3—43 to 60 inches; olive brown (2.5Y 4/4) loam, light yellowish brown (2.5Y 6/4) dry; few fine prominent dark red (2.5YR 3/6) and strong brown (7.5YR 4/6) redoximorphic concentrations and gray (10YR 6/1) redoximorphic depletions; massive; slightly hard, friable, sticky and plastic; about 10 percent gravel; slight effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 25 inches
Notes: The mollic epipedon has an electrical conductivity of more than 16 mmhos/cm and a SAR of more than 13.

Ap horizon:
Hue: 10YR, 2.5Y, 5Y, or neutral
Value: 2 or 3, 3 or 4 dry
Chroma: 0 or 1
Texture: clay loam or loam

ABkyz horizon:
Hue: 10YR or neutral
Value: 3 or 4, 5 or 6 dry
Chroma: 0 or 1

Bky horizon:
Hue: 2.5Y, 5Y, or neutral
Value: 4 to 6, 5 to 7 dry
Chroma: 0 to 2
Texture: clay loam, loam, or silty clay loam

C horizon:
Hue: 2.5Y, 5Y, or neutral
Value: 3 to 5, 5 to 7 dry
Chroma: 0 to 4

Eckman Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope: 0 to 9 percent

Taxonomic class: Coarse-silty, mixed, superactive Udic Haploborolls

Typical pedon:
Eckman loam, from an area of Eckman-Zell loams, 3 to 6 percent slopes, 2,140 feet east and 2,100 feet north of the southwest corner of sec. 19, T. 134 N., R. 55 W.

Ap—0 to 6 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; slightly alkaline; abrupt smooth boundary.

Bw—6 to 13 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; slightly alkaline; clear wavy boundary.

Bk—13 to 37 inches; light yellowish brown (2.5Y 6/4) silt loam, pale yellow (2.5Y 7/4) dry; weak medium subangular blocky structure; soft and friable; slightly sticky and slightly plastic; violent effervescence; moderately alkaline; gradual wavy boundary.

C—37 to 60 inches; light yellowish brown (2.5Y 6/4) very fine sandy loam, pale yellow (2.5Y 8/4) dry; massive; soft and very friable; slightly sticky and nonplastic; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 16 inches
Depth to lime: 10 to 36 inches
Notes: Some pedons have clay loam below a depth of 40 inches.

Ap horizon:
Value: 2 or 3, 3 to 5 dry

Bw horizon:
Hue: 10YR or 2.5Y
Value: 3 to 5, 4 to 6 dry
Chroma: 2 to 4
Texture: silt loam or loam

Bk horizon:
Hue: 10YR or 2.5Y
Value: 5 or 6, 6 to 8 dry
Chroma: 2 to 4
Texture: silt loam or loam

C horizon:
Hue: 10YR or 2.5Y
Value: 5 or 6, 6 to 8 dry
Chroma: 2 to 4
Texture: very fine sandy loam, silt loam, or loam, but may be stratified with very fine sand or fine sandy loam.

Edgeley Series

Depth class: Moderately deep
Drainage class: Well drained
Permeability: Moderate
Landform: Valleys
Parent material: Colluvium over till
Slope: 0 to 35 percent

Taxonomic class: Fine-loamy, mixed, superactive Udic Haploborolls

Typical pedon:
Edgeley loam, 1,490 feet east and 1,150 feet north of the southwest corner of sec. 19, T. 149 N., R. 58 W.

Ap—0 to 6 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many roots; slightly acid; abrupt smooth boundary.

BA—6 to 15 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) dry; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many roots; few fragments of shale; neutral; clear smooth boundary.

Bw—15 to 32 inches; dark grayish brown (2.5Y 4/2) silty clay loam, brown (10YR 5/3) dry; few fine faint light olive brown (2.5Y 5/4) dry redoximorphic concentrations; weak coarse prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, sticky and plastic; few roots; slightly alkaline; abrupt smooth boundary.

2Cr—32 to 60 inches; very dark gray (5Y 3/1) soft shale bedrock, gray (5Y 5/1) dry; segregations of lime along fractures; slight effervescence.

Range in Characteristics

Mollic epipedon thickness: 7 to 16 inches
Depth to soft bedrock: 20 to 40 inches
Notes: Some pedons have a Bk horizon.

Ap horizon:
Hue: 10YR or 2.5Y
Value: 2 or 3, 3 or 4 dry
Texture: loam, clay loam, silt loam, or silty clay loam

Bw horizon:
Hue: 10YR or 2.5Y
Value: 2 to 4, 4 to 6 dry
Chroma: 1 to 3
Texture: loam, silt loam, silty clay loam, or clay loam
Notes: It has up to 35 percent shale channers.

Cr horizon:
Hue: 2.5Y or 5Y
Value: 3 to 5, 5 to 7 dry
Chroma: 1 to 3
Notes: It is weathered shale bedrock.

Egeland Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Delta plains
Parent material: Glaciolacustrine deposits
Slope: 0 to 3 percent

Taxonomic class: Coarse-loamy, mixed, superactive Udic Haploborolls

Typical Pedon:
Egeland fine sandy loam, 2,220 feet north and 630 feet west of the southeast corner of sec. 32, T. 158 N., R. 65 W.

Ap—0 to 7 inches; black (10YR 2/1) fine sandy loam, dark gray (10YR 4/1) dry; weak fine and medium subangular blocky structure parting to weak fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, medium and coarse roots; neutral; abrupt wavy boundary.

Bw—7 to 15 inches; olive brown (2.5Y 4/3) fine sandy loam, light olive brown (2.5Y 5/3) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; tongues of A horizon material extend 4 to 5 inches into the upper part; neutral; clear wavy boundary.

Bk1—15 to 26 inches; light olive brown (2.5Y 5/3) fine sandy loam, light yellowish brown (2.5Y 6/3) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots; slightly alkaline; strong effervescence throughout (HCl, unspecified); clear wavy boundary.

Bk2—26 to 44 inches; light olive brown (2.5Y 5/3) loamy fine sand, pale yellow (2.5Y 7/3) dry; weak coarse subangular blocky structure parting to weak medium subangular blocky; soft, very friable, nonsticky and nonplastic; few very fine roots; slightly alkaline; common fine and medium soft masses of lime pedogenic; slight effervescence throughout (HCl, unspecified); clear wavy boundary.

C—44 to 60 inches; light olive brown (2.5Y 5/3) loamy sand, light yellowish brown (2.5Y 6/3) dry; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; moderately alkaline; slight effervescence throughout (HCl, unspecified).

Range in Characteristics

Mollic epipedon thickness: 7 to 16 inches

Ap horizon:
Value: 2 or 3, 3 or 4 dry

Bw horizon:
Value: 2 to 5, 4 to 6 dry
Chroma: 1 to 4

Bk horizon:
Value: 4 or 5
Chroma: 2 to 4

C horizon:
Value: 4 or 5, 6 or 7 dry
Chroma: 2 to 4
Texture: fine sandy loam, sandy loam, or loamy sand

Embden Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately rapid
Landform: Delta plains
Parent material: Glaciofluvial deposits
Slope: 0 to 6 percent

Taxonomic class: Coarse-loamy, mixed, superactive Pachic Udic Haploborolls

Typical pedon:
Embden fine sandy loam, 0 to 6 percent slopes, 2,550 feet north and 370 feet west of the southeast corner of sec. 21, T. 133 N., R. 54 W.

Ap—0 to 7 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine granular structure; slightly hard, very friable, slightly sticky and nonplastic; many very fine roots; neutral; abrupt smooth boundary.

A—7 to 12 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; slightly hard, very friable, slightly sticky and nonplastic; many very fine roots; neutral; gradual wavy boundary.

Bw1—12 to 21 inches; very dark brown (10YR 2/2) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; many fine roots; neutral; gradual wavy boundary.

Bw2—21 to 25 inches; very dark grayish brown (2.5Y 3/2) fine sandy loam, dark grayish brown (2.5Y 4/2) dry; moderate medium subangular blocky structure; slightly hard, very friable; slightly sticky and nonplastic; common fine roots; slight effervescence; slightly alkaline; gradual wavy boundary.

Bk1—25 to 29 inches; grayish brown (10YR 5/2) fine sandy loam, light gray (10YR 7/2) dry; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; common fine roots; violent effervescence; moderately alkaline; clear wavy boundary.

Bk2—29 to 38 inches; dark grayish brown (10YR 4/2) fine sandy loam, light brownish gray (10YR 6/2) dry; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; strong effervescence; moderately alkaline; gradual wavy boundary.

Bk3—38 to 44 inches; brown (10YR 5/3) fine sandy loam, pale brown (10YR 6/3) dry; few fine faint light yellowish brown (10YR 6/4) redoximorphic concentrations; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; strong effervescence; moderately alkaline; gradual wavy boundary.

C—44 to 60 inches; dark brown (10YR 4/3) loamy fine sand, brown (10YR 5/3) dry; few fine distinct light yellowish brown (10YR 6/4) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; slight effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 16 to 40 inches
Depth to lime: 20 to 60 inches

A horizon:
Hue: 10YR or neutral
Value: 2 or 3, 3 or 4 dry
Chroma: 0 or 1

Bw horizon:
Value: 2 to 4, 3 to 5 dry
Chroma: 1 to 4
Texture: fine sandy loam or sandy loam

C horizon:
Hue: 2.5Y or 10YR
Value: 4 to 6, 5 to 7 dry
Chroma: 2 to 4
Texture: fine sandy loam, sandy loam, or loamy fine sand

Exline Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Very slow
Landform: Lake plains

Parent material: Glaciolacustrine deposits
Slope: 0 to 1 percent
Notes: These soils are saline-sodic.

Taxonomic class: Fine, smectitic Leptic Natriborolls

Typical pedon:
Exline loam, 1,020 feet east and 190 feet north of the southwest corner of sec. 34, T. 133 N., R. 53 W.

E—0 to 1 inch; very dark gray (10YR 3/1) loam, gray (10YR 6/1) dry; weak fine platy structure; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt wavy boundary.

Btknz—1 to 7 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; strong medium columnar structure parting to strong fine angular blocky; extremely hard, very firm, very sticky and very plastic; many very fine roots; common thin continuous clay films on vertical faces of peds; few fine salt accumulations; common medium irregularly shaped masses of lime; slight effervescence; moderately alkaline; clear wavy boundary.

Btkny—7 to 12 inches; very dark gray (10YR 3/1) silty clay, gray (10YR 5/1) dry; strong medium prismatic structure parting to strong fine subangular blocky; extremely hard, very firm, very sticky and very plastic; many very fine roots; common thin continuous clay films on vertical faces of peds; few fine irregular nests of gypsum; common medium irregularly shaped masses of lime; slight effervescence; moderately alkaline; gradual wavy boundary.

Bky1—12 to 29 inches; grayish brown (2.5Y 5/2) silty clay, light brownish gray (2.5Y 6/2) dry; moderate medium subangular blocky structure; extremely hard, firm, sticky and plastic; common very fine roots; common fine tongues of dark surface material coat crack sides; common medium irregular nests of gypsum; common medium irregularly shaped masses of lime; slight effervescence; strongly alkaline; gradual wavy boundary.

Bky2—29 to 35 inches; dark grayish brown (2.5Y 4/2) silty clay, grayish brown (2.5Y 5/2) dry; common medium prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; weak medium subangular blocky structure; extremely hard, firm, sticky and plastic; many medium irregular nests of gypsum; many medium irregularly shaped masses of lime; slight effervescence; moderately alkaline; gradual wavy boundary.

C—35 to 60 inches; stratified grayish brown (2.5Y 5/2) very fine sand and silty clay, light gray (2.5Y 7/2) dry; many medium distinct light olive brown (2.5Y 5/6) redoximorphic concentrations; massive; extremely hard, firm, sticky and plastic; many medium irregular nests of gypsum; strong effervescence; moderately alkaline.

Range in Characteristics

Depth to lime: 1 to 16 inches
Depth to gypsum or other salts: 1 to 16 inches
Notes: Some pedons have an A horizon. Some pedons have sandy material below a depth of 40 inches.

E horizon:
Value: 3 to 5, 5 or 6 dry
Notes: When cultivated, the E horizon commonly is absent.

Btkn horizon:
Hue: 10YR or 2.5Y
Value: 2 to 4, 3 to 5 dry
Chroma: 1 or 2
Texture: silty clay or clay

Bky horizon:
Hue: 10YR or 2.5Y
Value: 3 to 5, 4 to 6 dry
Chroma: 1 to 3
Texture: silty clay, clay, or silty clay loam

C horizon:
Hue: 2.5Y or 5Y
Value: 3 to 7, 5 to 8 dry
Chroma: 2 to 4

Fairdale Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate
Landform: Flood plains
Parent material: Alluvium
Slope: 0 to 6 percent
Notes: These soils are calcareous.

Taxonomic class: Fine-loamy, mixed, superactive, calcareous, frigid Mollic Udifluvents

Typical pedon:
Fairdale loam, 0 to 6 percent slopes, 2,350 feet south and 1,020 feet east of the northwest corner of sec. 17, T. 135 N., R. 57 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; slight effervescence; slightly alkaline; abrupt smooth boundary.

A—7 to 13 inches; thinly stratified very dark brown (10YR 2/2) loam and fine sandy loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; slight effervescence; slightly alkaline; clear wavy boundary.

C1—13 to 33 inches; stratified dark brown (10YR 3/3) loam and fine sandy loam, brown (10YR 5/3) dry; massive; slightly hard, very friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—33 to 60 inches; stratified dark brown (10YR 3/3) loam and fine sandy loam, brown (10YR 5/3) dry; massive; slightly hard, very friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline.

Range in Characteristics

A horizon:
Hue: 10YR or 2.5Y
Value: 2 or 3, 4 or 5 dry
Chroma: 1 or 2

C horizon:
Hue: 10YR or 2.5Y
Value: 3 to 5, 4 to 7 dry
Chroma: 1 to 3

Falsen Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Rapid
Landform: Delta plains and outwash plains
Parent material: Glaciofluvial deposits
Slope: 0 to 3 percent
Taxonomic class: Sandy, mixed Oxyaquic Haploborolls

Typical pedon:
Falsen loamy sand, 0 to 3 percent slopes, 750 feet west and 150 feet south of the northeast corner of sec. 2, T. 133 N., R. 54 W.

Ap—0 to 7 inches; black (10YR 2/1) loamy sand, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; neutral; abrupt smooth boundary.

A—7 to 12 inches; black (10YR 2/1) loamy sand, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine roots; neutral; clear wavy boundary.

Bw—12 to 25 inches; very dark grayish brown (10YR 3/2) loamy sand, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; few very fine roots; neutral; gradual wavy boundary.

C—25 to 60 inches; dark yellowish brown (10YR 3/4) sand, yellowish brown (10YR 5/4) dry; common medium prominent strong brown (7.5YR 5/6) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; very slight effervescence in the lower part; slightly alkaline.

Range in Characteristics

Mollic epipedon thickness: More than 20 inches

A horizon:
Value: 2 or 3, 3 to 5 dry

Bw horizon:
Texture: coarse sand, loamy coarse sand, or loamy sand

C horizon:
Hue: 10YR or 2.5Y
Value: 3 to 6, 4 to 7 dry
Chroma: 2 to 4
Texture: sand, coarse sand, loamy coarse sand, or loamy sand
Notes: It has up to 5 percent gravel in some pedons.

Fargo Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope: 0 to 1 percent

Taxonomic class: Fine, smectitic, frigid Typic Epiaquerts

Typical Pedon:
Fargo silty clay, 2,600 feet south and 1,900 feet east of the northwest corner of sec. 35, T. 157 N., R. 66 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure parting to strong fine granular; very hard, friable, very sticky and very plastic; common very fine roots; neutral; abrupt smooth boundary.

Bw—8 to 18 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure parting to strong very fine angular blocky; very hard, firm, very sticky and very plastic; few very fine roots; cracks filled with A horizon material extend throughout; slightly alkaline; abrupt smooth boundary.

Bkg—18 to 35 inches; dark gray (5Y 4/1) silty clay, gray (5Y 5/1) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; very hard, friable, moderately sticky and moderately plastic; cracks filled with A horizon material extend throughout; moderately alkaline; few fine irregular soft masses of lime pedogenic and common medium prominent light yellowish brown (2.5Y 6/4) masses of iron accumulation pedogenic; strong effervescence throughout (HCl, unspecified); abrupt smooth boundary.

Cg1—35 to 46 inches; olive gray (5Y 5/2) clay, gray (5Y 6/1) dry; massive; very hard, firm, moderately sticky and moderately plastic; moderately alkaline; many medium prominent light yellowish brown (2.5Y 6/4) masses of iron accumulation pedogenic; strong effervescence throughout (HCl, unspecified); gradual wavy boundary.

Cg2—46 to 60 inches; olive gray (5Y 4/2) clay, light olive gray (5Y 6/2) dry; massive; very hard, firm, moderately sticky and moderately plastic; moderately alkaline; strong effervescence throughout (HCl, unspecified).

Range in Characteristics

Mollic epipedon thickness: 8 to 24 inches
Depth to lime: 11 to 25 inches

Ap horizon:
Hue: 10YR, 2.5Y, 5Y, or neutral
Value: 1 or 2, 3 or 4 dry
Chroma: 0 or 1

Bw horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 2 to 4, 3 to 5 dry
Chroma: 1 or 2

Bkg horizon:
Hue: 2.5Y or 5Y
Value: 3 to 6, 5 to 7 dry
Chroma: 1 or 2

Cg horizon:
Hue: 2.5Y or 5Y
Value: 4 to 6, 5 to 8 dry
Chroma: 1 to 3
Notes: It has gypsum crystals in some pedons.

Fordville Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate over rapid
Landform: Outwash plains
Parent material: Glaciofluvial deposits
Slope: 0 to 1 percent

Taxonomic class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive Pachic Udic Haploborolls

Typical pedon:
Fordville loam, 700 feet south and 340 feet east of the northwest corner of sec. 10, T. 136 N., R. 58 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; neutral; abrupt smooth boundary.

Bw1—9 to 16 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly

hard, friable, slightly sticky and slightly plastic; many very fine roots; neutral; clear wavy boundary.

Bw2—16 to 23 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; neutral; clear wavy boundary.

BC—23 to 30 inches; dark brown (10YR 4/3) loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; few very fine roots; slightly alkaline; clear wavy boundary.

2C1—30 to 36 inches; dark grayish brown (10YR 4/2) very gravelly loamy sand, grayish brown (10YR 5/2) dry; single grain; loose; nonsticky and nonplastic; about 45 percent gravel; slight effervescence; slightly alkaline; clear smooth boundary.

C2—36 to 60 inches; dark grayish brown (10YR 4/2) gravelly coarse sand, grayish brown (10YR 5/2) dry; single grain; loose; nonsticky and nonplastic; about 20 percent gravel; slight effervescence; slightly alkaline.

Range in Characteristics

Mollic epipedon thickness: 16 to 30 inches
Depth to sand and gravel: 20 to 40 inches
Notes: Some pedons have a Bk horizon.

Ap horizon:
Value: 2 or 3, 3 or 4 dry

Bw horizon:
Value: 2 to 4, 3 to 5 dry
Chroma: 2 to 4
Texture: loam or clay loam

BC horizon:
Hue: 10YR or 2.5Y
Value: 3 to 6, 4 to 8 dry
Chroma: 2 or 3
Texture: loam or clay loam

2C horizon:
Hue: 10YR or 2.5Y
Value: 3 to 6, 4 to 7 dry
Chroma: 2 to 4
Texture: loamy sand, sand, or coarse sand
Notes: It has up to 50 percent gravel.

Forman Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately slow
Landform: Till plains
Parent material: Glacial till
Slope: 0 to 30 percent

Taxonomic class: Fine-loamy, mixed, superactive Udic Argiborolls

Typical pedon:
Forman clay loam, 1,250 feet east and 150 feet south of northwest corner of sec. 18, T. 130 N., R. 55 W.

Ap—0 to 8 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak fine granular structure; hard, friable; many fine roots; many fine pores; neutral; abrupt smooth boundary.

Bt1—8 to 14 inches; dark brown (10YR 3/3) clay loam, brown (10YR 4/3) dry; moderate medium prismatic and moderate medium and fine angular blocky structure; very hard, friable; common fine roots; many faint very dark grayish brown (10YR 3/2) clay films on faces of peds; 1/8 to 1 inch black (10YR 2/1) tongues of A horizon; neutral; gradual smooth boundary.

Bt2—14 to 17 inches; dark grayish brown (2.5Y 4/2) clay loam, grayish brown (2.5Y 5/2) dry; moderate medium prismatic and moderate medium subangular blocky structure; very hard, friable; few fine roots; many distinct clay films on faces of peds; strong effervescence in the interior of prisms and blocks; slightly alkaline; clear wavy boundary

Bk—17 to 44 inches; light olive brown (2.5Y 5/4) clay loam, light yellowish brown (2.5Y 6/4) dry; weak coarse prismatic structure; very hard, friable; many fine masses of lime; violent effervescence; moderately alkaline; diffuse wavy boundary.

Bky—44 to 60 inches; grayish brown and light olive brown (2.5Y 5/2 and 5/4) clay loam, light yellowish brown (2.5Y 6/4) dry; few fine distinct light olive brown (2.5Y 5/6) redoximorphic concentrations; weak coarse and fine subangular blocky structure; friable; common fine masses of lime; many small nests of gypsum crystals; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 16 inches
Notes: Some pedons have a loam or clay loam C horizon below the Bk horizon.

Ap horizon:
Value: 3 or 4 dry
Texture: loam or clay loam

Bt horizon:
Chroma: 1 to 4
Notes: It averages 30 to 35 percent clay.

Bk horizon:
Hue: 10YR or 2.5Y
Value: 4 to 6, 5 to 7 dry
Texture: clay loam or loam
Notes: Some pedons do not have a Bky horizon.

Fossum Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Rapid
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope: 0 to 1 percent
Notes: These soils are calcareous.

Taxonomic class: Sandy, mixed, calcareous, frigid Typic Endoaquolls

Typical pedon:
Fossum sandy loam, 1,100 feet east and 160 feet south of the northwest corner of sec. 25, T. 122 N., R. 40 W.

Ap—0 to 8 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; slight effervescence throughout (HCl, unspecified); moderately alkaline; abrupt smooth boundary.

A1—8 to 13 inches; very dark gray (N 3/0) loamy sand, dark gray (N 4/0) dry; massive; very friable; strong effervescence throughout (HCl, unspecified); moderately alkaline; clear smooth boundary.

A2—13 to 21 inches; very dark grayish brown (2.5Y 3/2) sand, dark grayish brown (2.5Y 4/2) dry; single grain; loose; common fine faint gray (5Y 5/1) redoximorphic depletions and brown (10YR 5/3) redoximorphic concentrations; strong effervescence throughout (HCl, unspecified); moderately alkaline; clear smooth boundary.

Cg1—21 to 26 inches; olive gray (5Y 5/2) fine sand; single grain; loose; common medium distinct light olive brown (2.5Y 5/6) redoximorphic concentrations; strong effervescence throughout (HCl, unspecified); moderately alkaline; clear wavy boundary.

Cg2—26 to 60 inches; light olive gray (5Y 6/2) fine sand; single grain; loose; common coarse prominent brownish yellow (10YR 6/8) redoximorphic concentrations; strong effervescence on upper surfaces of peds or rocks (HCl, unspecified); moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 10 to 24 inches
Depth to lime: 0 to 10 inches
Depth to loamy fine sand or coarser material: Less than 20 inches
Notes: Some pedons have a Bk horizon, but it has a calcium carbonate equivalent of less than 15 percent. Some pedons have glacial till or up to 35 percent gravel below a depth of 40 inches.

A horizon:
Texture: loamy sand, loamy fine sand, sandy loam, fine sandy loam, or loam
Notes: The calcium carbonate equivalent is less than 15 percent.

Cg horizon:
Texture: sand, fine sand, loamy sand, or loamy fine sand

Gardena Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope: 0 to 6 percent

Taxonomic class: Coarse-silty, mixed, superactive Pachic Udic Haploborolls

Typical pedon:
Gardena loam, in an area of Gardena-Eckman loams, 0 to 3 percent slopes, 1,050 feet north and 380 feet west of the southeast corner of sec. 13, T. 135 N., R. 55 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure parting to moderate medium granular; hard, friable, slightly sticky and slightly plastic; few very fine roots; slightly alkaline; abrupt smooth boundary.

A—8 to 14 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; hard, friable; slightly sticky and slightly plastic; few very fine roots; slightly alkaline; gradual wavy boundary.

Bw1—14 to 20 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; slightly alkaline; gradual wavy boundary.

Bw2—20 to 31 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; few fine irregularly shaped masses of lime; slight effervescence; moderately alkaline; clear wavy boundary.

Bk—31 to 43 inches; olive brown (2.5Y 4/4) silt loam, light yellowish brown (2.5Y 6/4) dry; moderate medium subangular blocky structure; slightly hard and friable; slightly sticky and slightly plastic; strong effervescence; moderately alkaline; gradual wavy boundary.

C—43 to 60 inches; grayish brown (2.5Y 5/2) silt loam, light brownish gray (2.5Y 6/2) dry; common medium distinct gray (5Y 5/1) redoximorphic depletions and many medium distinct olive yellow (2.5Y 6/6) redoximorphic concentrations; massive; slightly hard, friable; slightly sticky and slightly plastic; slight effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 16 to 40 inches
Depth to lime: 20 to 40 inches

Bw horizon:
Hue: 10YR or 2.5Y
Value: 2 to 4, 3 to 5 dry
Chroma: 1 to 3
Notes: Faint redoximorphic features are in the lower part in some pedons.

Bk horizon:
Hue: 10YR or 2.5Y
Value: 4 to 6, 5 to 7 dry

C horizon:
Hue: 10YR or 2.5Y
Value: 4 to 6, 5 to 7 dry
Chroma: 2 to 4
Texture: silt loam or very fine sandy loam
Notes: It does not have redoximorphic features in some pedons.

Glyndon Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope: 0 to 1 percent
Notes: These soils are highly calcareous.

Taxonomic class: Coarse-silty, mixed, superactive, frigid Aeric Calciaquolls

Typical pedon:
Glyndon loam, 2,520 feet east and 580 feet north of the southwest corner of sec. 23, T. 133 N., R. 53 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; strong effervescence; slightly alkaline; abrupt smooth boundary.

Bk—8 to 23 inches; light brownish gray (10YR 6/2) loam, light gray (10YR 7/1) dry; weak fine subangular blocky structure parting to weak fine granular; hard, very friable, slightly sticky and slightly plastic; many very fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

C1—23 to 31 inches; light yellowish brown (2.5Y 6/4) silt loam, pale yellow (2.5Y 7/4) dry; massive; hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—31 to 43 inches; light yellowish brown (2.5Y 6/4) very fine sandy loam, pale yellow (2.5Y 7/4) dry; few fine distinct grayish brown (2.5Y 5/2) redoximorphic depletions and few fine prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; massive; loose; nonsticky and nonplastic; slight effervescence; moderately alkaline; gradual wavy boundary.

C3—43 to 60 inches; light olive brown (2.5Y 5/4) very fine sand, pale yellow (2.5Y 7/4) dry; few fine distinct grayish brown (2.5Y 5/2) redoximorphic

depletions and common fine prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; slightly alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 16 inches
Salinity: The soil is saline in some map units.

Ap horizon:
Value: 2 or 3

Bk horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 7
Chroma: 1 to 4
Texture: very fine sandy loam, loam, or silt loam
Notes: It has redoximorphic features throughout in some pedons.

C horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6
Chroma: 2 to 4
Notes: It has redoximorphic features throughout in some pedons.

Great Bend Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope: 3 to 15 percent

Taxonomic class: Fine-silty, mixed, superactive Udic Haploborolls

Typical pedon:
Great Bend silt loam, 1,100 feet south and 130 feet east of the northwest corner of sec. 29, T. 122 N., R. 62 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable; common fine roots throughout; neutral; abrupt smooth boundary.

Bw—8 to 13 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few fine roots throughout; neutral; clear wavy boundary.

Bk1—13 to 17 inches; light olive brown (2.5Y 5/4) silt loam, pale yellow (2.5Y 7/4) dry; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few roots throughout; many fine pores; strong effervescence throughout (HCl, unspecified); slightly alkaline; clear wavy boundary.

Bk2—17 to 29 inches; light olive brown (2.5Y 5/4) silt loam, pale yellow (2.5Y 7/4) dry; weak coarse subangular blocky and medium subangular blocky structure; slightly hard, very friable; few roots throughout; many fine pores; few fine gypsum threads; violent effervescence throughout (HCl, unspecified); moderately alkaline; gradual wavy boundary.

C1—29 to 46 inches; light yellowish brown (2.5Y 6/4) and olive brown (2.5Y 4/4) silt loam, light gray (2.5Y 7/2) and light olive brown (2.5Y 5/4) dry; massive; slightly hard, friable; strong effervescence throughout (HCl, unspecified); moderately alkaline; gradual wavy boundary.

C2—46 to 60 inches; light yellowish brown (2.5Y 6/4) silt loam, pale yellow (2.5Y 8/2) dry; common fine distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) redoximorphic concentrations; massive; slightly hard, friable; few fine iron-manganese concretions and few fine gypsum threads; strong effervescence throughout (HCl, unspecified); moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 16 inches
Depth to lime: 10 to 32 inches
Notes: Stratified loamy sand or glacial till is below a depth of 40 inches in some pedons.

Ap horizon:
Texture: silt loam or silty clay loam

Bw horizon:
Texture: silt loam or silty clay loam

Bk horizon:
Texture: silt loam or silty clay loam

C horizon:
Texture: silt loam or silty clay loam
Notes: The calcium carbonate equivalent ranges from 10 to 26 percent. It is varved with thin strata of very fine sand to clay in the lower part of some pedons.

Gwinner Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Slow
Landform: Till plains
Parent material: Glaciolacustrine deposits over glacial till
Slope: 0 to 6 percent

Taxonomic class: Fine, smectitic Pachic Udertic Argiborolls

Typical pedon:
Gwinner silty clay loam, in an area of Gwinner-Peever-Parnell complex, 0 to 3 percent slopes, 1,820 feet east and 130 feet south of the northwest corner of sec. 11, T. 133 N., R. 56 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and plastic; few very fine roots; neutral; abrupt smooth boundary.

A—7 to 11 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and plastic; few fine roots; neutral; clear wavy boundary.

Bt1—11 to 21 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; strong medium prismatic structure parting to moderate fine and medium angular blocky; hard, firm, sticky and plastic; few very fine roots; many distinct clay films on faces of peds; neutral; gradual wavy boundary.

2Bt2—21 to 27 inches; dark grayish brown (2.5Y 4/2) clay loam, grayish brown (2.5Y 5/2) dry; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, sticky and plastic; many faint clay films on faces of peds; about 6 percent gravel; common fine and medium streaks of Bt1 material throughout; slightly alkaline; clear wavy boundary.

2Bk—27 to 31 inches; light olive brown (2.5Y 5/3) clay loam, pale yellow (2.5Y 7/3) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; about 6 percent gravel; many fine irregularly shaped masses of lime; violent effervescence; moderately alkaline; gradual wavy boundary.

2Bky—31 to 38 inches; grayish brown (2.5Y 5/2) clay loam, light gray (2.5Y 7/2) dry; common fine distinct light yellowish brown (2.5Y 6/4) redoximorphic concentrations; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; about 6 percent gravel; common nests of gypsum; common fine irregularly shaped masses of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

2C—38 to 60 inches; light olive brown (2.5Y 5/3) loam, light yellowish brown (2.5Y 6/3) dry; common prominent gray (5Y 5/1) redoximorphic depletions and common medium faint light yellowish brown (2.5Y 6/4) redoximorphic concentrations; massive; slightly hard, friable, slightly sticky and slightly plastic; about 6 percent gravel; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 16 to 24 inches
Depth to lime: 20 to 33 inches
Percent rock fragments: 2 to 10 percent in the glacial till
Depth to glacial till: 18 to 32 inches

A horizon:
Value: 2 or 3

2Bk horizon:
Value: 4 or 5

2Bky horizon:
Value: 4 or 5

2C horizon:
Value: 4 or 5
Chroma: 2 to 4
Texture: clay loam or loam
Notes: It has a few nests of gypsum in some pedons.

Hamar Series

Depth class: Very deep
Drainage class: Poorly and somewhat poorly drained
Permeability: Rapid
Landform: Delta plains
Parent material: Glaciofluvial and eolian deposits
Slope: 0 to 1 percent

Taxonomic class: Sandy, mixed, frigid Typic Endoaquolls

Typical pedon:
Hamar loamy fine sand, in an area of Hecla-Hamar loamy fine sands, 0 to 3 percent slopes, 500 feet north and 300 feet west of the southeast corner of sec. 29, T. 133 N., R. 54 W.

Ap—0 to 9 inches; black (10YR 2/1) loamy fine sand, very dark gray (10YR 3/1) dry; single grain; soft, very friable, slightly sticky and nonplastic; common very fine roots; neutral; abrupt smooth boundary.

A—9 to 15 inches; black (10YR 2/1) loamy fine sand, very dark gray (10YR 3/1) dry; single grain; loose; nonsticky and nonplastic; common very fine roots; neutral; gradual wavy boundary.

AC—15 to 23 inches; very dark grayish brown (10YR 3/2) fine sand, dark grayish brown (10YR 4/2) dry; common fine distinct dark yellowish brown (10YR 4/4) and few fine faint black (10YR 2/1) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; neutral; clear wavy boundary.

C1—23 to 31 inches; light olive brown (2.5Y 5/4) fine sand, light brownish gray (2.5Y 6/2) dry; common medium prominent dark yellowish brown (10YR 4/6) and few medium prominent very dark brown (10YR 2/2) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; slight effervescence; slightly alkaline; clear wavy boundary.

C2—31 to 60 inches; light olive brown (2.5Y 5/4) fine sand, light brownish gray (2.5Y 6/2) dry; common fine prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; slight effervescence; slightly alkaline.

Range in Characteristics

Mollic epipedon thickness: 10 to 20 inches
Depth to lime: 22 to 50 inches
Notes: The combined thickness of the A and AC horizons ranges from 11 to 40 inches.

A horizon:
Hue: 10YR or 2.5Y
Value: 2 or 3, 3 to 5 dry
Chroma: 1 or 2
Texture: loamy fine sand or fine sandy loam

AC horizon:
Value: 2 or 3, 3 to 5 dry
Chroma: 1 or 2
Texture: fine sand, loamy fine sand, or loamy sand

C horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 3 to 5, 5 to 7 dry
Chroma: 1 to 4
Texture: loamy fine sand, loamy sand, or fine sand

Hamerly Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderately slow
Landform: Till plains
Parent material: Glacial till
Slope: 0 to 3 percent
Notes: These soils are highly calcareous.

Taxonomic class: Fine-loamy, mixed, superactive, frigid Aeric Calciaquolls

Typical pedon:
Hamerly loam, in an area of Hamerly-Tonka-Parnell complex, 0 to 3 percent slopes, 1,440 feet west and 160 feet south of the northeast corner of sec. 16, T. 134 N., R. 57 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; few fine and many very fine roots; about 1 percent gravel; slight effervescence; abrupt smooth boundary.

ABk—8 to 12 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; about 1 percent gravel; common medium irregularly shaped masses of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

Bk—12 to 22 inches; grayish brown (2.5Y 5/2) loam, light brownish gray (2.5Y 6/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; about 1 percent gravel; violent effervescence; moderately alkaline; gradual wavy boundary.

C1—22 to 36 inches; light olive brown (2.5Y 5/4) loam, olive brown (2.5Y 4/4) dry; few fine prominent gray

(5Y 5/1) redoximorphic depletions and distinct olive yellow (2.5Y 6/6) redoximorphic concentrations; massive; hard, firm, slightly sticky and slightly plastic; about 2 percent gravel; common medium rounded nests of gypsum; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—36 to 60 inches; light olive brown (2.5Y 5/4) loam, olive brown (2.5Y 4/4) dry; common medium prominent gray (5Y 5/1) redoximorphic depletions and distinct olive yellow (2.5Y 6/6) redoximorphic concentrations; massive; hard, firm, slightly sticky and slightly plastic; common medium rounded nests of gypsum; strong effervescence; moderately alkaline.

Range in Characteristics

Percent rock fragments: 1 to 10 percent

Ap horizon:
Hue: 10YR or 2.5Y
Value: 2 or 3
Notes: It does not have lime in some pedons.

ABk horizon:
Notes: Some pedons do not have an ABk horizon.

Bk horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 7
Chroma: 1 to 4
Texture: loam or clay loam

C horizon:
Hue: 2.5 or 5Y
Value: 4 to 6
Chroma: 1 to 4
Texture: loam or clay loam

Hecla Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Rapid
Landform: Delta plains
Parent material: Glaciofluvial and eolian deposits
Slope: 1 to 3 percent

Taxonomic class: Sandy, mixed Aquic Haploborolls

Typical pedon:
Hecla loamy fine sand, in an area of Hecla-Hamar loamy fine sands, 0 to 3 percent slopes, 700 feet west and 460 feet north of the southeast corner of sec. 21, T. 135 N., R. 54 W.

Ap—0 to 8 inches; black (10YR 2/1) loamy fine sand, very dark gray (10YR 3/1) dry; single grain; loose; nonsticky and nonplastic; many very fine roots; neutral; abrupt smooth boundary.

A—8 to 18 inches; black (10YR 2/1) loamy fine sand, very dark grayish brown (10YR 3/2) dry; single grain; loose; nonsticky and nonplastic; many very fine roots; neutral; gradual wavy boundary.

AC—18 to 27 inches; very dark brown (10YR 2/2) fine sand, dark grayish brown (10YR 4/2) dry; single grain; loose; nonsticky and nonplastic; many very fine roots; neutral; clear wavy boundary.

C1—27 to 33 inches; dark brown (10YR 4/3) fine sand, brown (10YR 5/3) dry; few fine distinct dark gray (10YR 4/1) redoximorphic depletions and common medium distinct yellowish brown (10YR 5/6) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; common very fine and few fine roots; slightly alkaline; gradual wavy boundary.

C2—33 to 60 inches; olive brown (2.5Y 4/4) fine sand, light olive brown (2.5Y 5/4) dry; few fine prominent very dark grayish brown (10YR 3/2) and many medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; few very fine roots; neutral.

Range in Characteristics

Mollic epipedon thickness: 10 to 20 inches
Depth to lime: 20 to more than 60 inches
Notes: Buried horizons are below a depth of 30 inches in some pedons. Some pedons have very fine sandy loam below a depth of 40 inches.

A horizon:
Value: 2 or 3, 3 or 4 dry

AC horizon:
Value: 2 or 3, 3 to 5 dry
Chroma: 1 or 2
Texture: loamy fine sand, fine sand, or loamy sand

C horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 3 to 5, 4 to 7 dry
Chroma: 2 to 4
Texture: loamy fine sand, loamy sand, or fine sand

Hegne Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Very slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope: 0 to 1 percent
Notes: These soils are highly calcareous.

Taxonomic class: Fine, smectitic, frigid Typic Calciaquerts

Typical pedon:
Hegne silty clay loam, 410 feet north and 370 feet west of the southeast corner of sec. 33, T. 133 N., R. 53 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; hard, firm, sticky and plastic; common very fine and few fine roots; slight effervescence; slightly alkaline; abrupt smooth boundary.

Bkg1—7 to 14 inches; dark gray (5Y 4/1) silty clay, gray (5Y 5/1) dry; moderate medium subangular blocky structure parting to strong very fine angular blocky; very hard, firm, very sticky and very plastic; few very fine roots; cracks filled with A material throughout; strong effervescence; moderately alkaline; clear wavy boundary.

Bkg2—14 to 24 inches; gray (5Y 5/1) silty clay, gray (5Y 6/1) dry; few fine distinct pale olive (5Y 6/3) redoximorphic concentrations; strong very fine angular blocky structure; very hard, firm, very sticky and very plastic; few very fine roots; cracks filled with A material throughout; few fine irregularly shaped nests of gypsum; violent effervescence; moderately alkaline; gradual wavy boundary.

Cg1—24 to 44 inches; olive gray (5Y 5/2) silty clay, light olive gray (5Y 6/2) dry; few fine prominent dark reddish brown (5YR 3/3) and many fine prominent light yellowish brown (2.5Y 6/4) redoximorphic concentrations; massive; very hard, firm, very sticky and very plastic; common fine irregularly shaped nests of gypsum; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg2—44 to 60 inches; olive gray (5Y 5/2) silty clay, light gray (5Y 7/2) dry; few fine prominent very dark brown (10YR 2/2) and many fine prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; massive; hard, firm, sticky and plastic; violent effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 16 inches

Ap horizon:
Hue: 10YR or 2.5Y
Value: 2 or 3

Bkg horizon:
Hue: 2.5Y or 5Y
Value: 4 to 6
Chroma: 1 or 2
Texture: silty clay, clay, or silty clay loam

Cg horizon:
Hue: 2.5Y or 5Y
Value: 4 to 6
Chroma: 1 or 2
Texture: silty clay, clay, or silty clay loam

Kranzburg Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately slow
Landform: Till plains
Parent material: Glaciolacustrine deposits over glacial till
Slope: 0 to 6 percent

Taxonomic class: Fine-silty, mixed, superactive Udic Haploborolls

Typical pedon:
Kranzburg silty clay loam, in an area of Kranzburg-Lismore silty clay loams, 2 to 6 percent slopes, 2,300 feet west and 300 feet south of the northeast corner of sec. 6, T. 136 N., R. 57 W.

Ap—0 to 9 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; strong coarse subangular blocky structure; hard, friable, sticky and plastic; common fine and very fine roots; neutral; abrupt smooth boundary.

Bw1—9 to 14 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; strong coarse subangular blocky structure; hard, friable, sticky and plastic; few fine and very fine roots; neutral; gradual wavy boundary.

Bw2—14 to 27 inches; dark grayish brown (2.5Y 4/2) silty clay loam, grayish brown (2.5Y 5/2) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; neutral; gradual wavy boundary.

2Bk1—27 to 32 inches; olive brown (2.5Y 4/4) clay loam, light yellowish brown (2.5Y 6/4) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine irregularly shaped masses of lime; strong effervescence; moderately alkaline; clear wavy boundary.

2Bk2—32 to 39 inches; light olive brown (2.5Y 5/4) clay loam, light gray (2.5Y 7/2) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common medium irregularly shaped masses of lime; strong effervescence; moderately alkaline; clear wavy boundary.

2C—39 to 60 inches; light olive brown (2.5Y 5/4) loam, light brownish gray (2.5Y 6/2) dry; massive; hard, friable, slightly sticky and slightly plastic; common medium irregularly shaped masses of lime; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 6 to 16 inches
Depth to lime: 19 to 32 inches
Depth to glacial till: 20 to 40 inches

Ap horizon:
Value: 2 or 3, 3 or 4 dry

Bw horizon:
Value: 3 to 5 dry
Chroma: 2 or 3

2Bk horizon:
Hue: 10YR or 2.5Y
Value: 4 to 6, 5 to 7 dry
Texture: loam or clay loam

2C horizon:
Hue: 10YR or 2.5Y
Value: 4 to 6, 5 to 7 dry
Texture: loam or clay loam

La Prairie Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate
Landform: Flood plains
Parent material: Alluvium
Slope: 0 to 1 percent

Taxonomic class: Fine-loamy, mixed, superactive Cumulic Udic Haploborolls

Typical pedon:
La Prairie loam, 1,750 feet east and 140 feet north of the southwest corner of sec. 29, T. 134 N., R. 54 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 4/1) dry; moderate medium subangular blocky structure parting to weak fine granular; hard, friable, slightly sticky and slightly plastic; many very fine and few fine roots; neutral; abrupt smooth boundary.

A—8 to 17 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine and few fine roots; neutral; gradual wavy boundary.

Bw1—17 to 26 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; slight effervescence; slightly alkaline; gradual wavy boundary.

Bw2—26 to 35 inches; very dark grayish brown (2.5Y 3/2) loam, dark grayish brown (2.5Y 4/2) dry; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine filaments of lime; slight effervescence; slightly alkaline; gradual wavy boundary.

C—35 to 60 inches; dark grayish brown (10YR 4/2) loam, grayish brown (10YR 5/2) dry; massive; hard, friable, slightly sticky and slightly plastic; few fine filaments of lime; slight effervescence; slightly alkaline.

Range in Characteristics

Mollic epipedon thickness: 16 to more than 40 inches
Depth to lime: 0 to 30 inches

A horizon:
Value: 2 or 3

Bw horizon:
Value: 2 to 4, 3 to 5 dry
Chroma: 1 to 3

C horizon:
Hue: 10YR or 2.5Y
Value: 3 to 5, 4 to 7 dry
Chroma: 1 to 3
Notes: It has strata of sand to silt loam below a depth of 40 inches in some pedons.

LaDelle Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow
Landform: Flood plains
Parent material: Alluvium
Slope: 0 to 1 percent

Taxonomic class: Fine-silty, mixed, superactive Cumulic Udic Haploborolls

Typical pedon:
LaDelle silt loam, 500 feet east and 1,500 feet north of the southwest corner of sec. 17, T. 136 N., R. 57 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, very dark gray (10YR 4/1) dry; moderate medium subangular blocky structure parting to moderate coarse granular; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; neutral; abrupt smooth boundary.

A—8 to 20 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to moderate medium granular; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; neutral; gradual wavy boundary.

Bw—20 to 30 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; many very fine and common fine roots; neutral; clear wavy boundary.

Bk1—30 to 42 inches; very dark grayish brown (2.5Y 3/2) silty clay loam, dark grayish brown (2.5Y 4/2) dry; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few fine irregularly shaped masses of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

Bk2—42 to 50 inches; very dark grayish brown (2.5Y 3/2) silty clay loam, grayish brown (2.5Y 5/2) dry; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine irregularly shaped masses of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C—50 to 60 inches; dark grayish brown (2.5Y 4/2) silty clay loam, light brownish gray (2.5Y 6/2) dry; few fine prominent olive (5Y 4/4) redoximorphic concentrations; massive; very hard, firm, sticky and plastic; few fine irregularly shaped masses of lime; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 50 inches
Depth to lime: 0 to 30 inches
Notes: Buried horizons are below a depth of 17 inches in some pedons.

A horizon:
Value: 2 or 3

Bw horizon:
Notes: Some pedons do not have a Bw horizon.

Bk horizon:
Hue: 10YR or 2.5Y
Value: 2 to 4, 3 to 6 dry
Chroma: 1 to 3
Texture: silty clay loam, silt loam, or loam

C horizon:
Hue: 10YR or 2.5Y
Value: 2 to 4, 3 to 6 dry
Chroma: 1 to 3
Notes: It has thin strata of clay loam or clay below a depth of 40 inches in some pedons.

Lamoure Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderately slow
Landform: Flood plains
Parent material: Alluvium
Slope: 0 to 1 percent
Notes: These soils are calcareous.

Taxonomic class: Fine-silty, mixed, superactive, calcareous, frigid Cumulic Endoaquolls

Typical pedon:
Lamoure silt loam, 400 feet north and 1,300 feet west of the southeast corner of sec. 7, T. 136 N., R. 57 W.

A1—0 to 10 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure; hard, friable, sticky and plastic; many fine and very fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

A2—10 to 20 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure; very hard, friable, sticky and plastic; many very fine and common fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

A3—20 to 26 inches; black (N 2/0) silty clay loam, dark gray (N 4/0) dry; moderate medium angular blocky structure; very hard, friable, sticky and plastic; few very fine roots; few fine irregularly shaped masses of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg1—26 to 33 inches; dark gray (5Y 4/1) silty clay loam, gray (5Y 5/1) dry; massive; very hard, firm, sticky and plastic; many fine irregularly shaped masses of lime; violent effervescence; moderately alkaline; clear wavy boundary.

Cg2—33 to 43 inches; olive gray (5Y 4/2) silty clay loam, gray (5Y 6/1) dry; massive; very hard, firm, sticky and plastic; violent effervescence; moderately alkaline; gradual wavy boundary.

Cg3—43 to 60 inches; olive gray (5Y 4/2) silty clay loam, gray (5Y 6/1) dry; few fine distinct pale olive (5Y 6/3) redoximorphic concentrations; massive; hard, friable, sticky and plastic; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 24 to 42 inches
Depth to lime: 0 to 10 inches
Notes: Ab horizons are below a depth of 30 inches in some pedons.

A horizon:
Hue: 10YR, 2.5Y, 5Y, or neutral
Value: 2 or 3, 3 to 5 dry
Chroma: 0 or 1

Cg horizon:
Hue: 2.5Y, 5Y, or neutral
Value: 3 to 5, 4 to 6 dry
Chroma: 0 to 2
Notes: It is stratified loam or silt loam below a depth of 40 inches in some pedons.

Langhei Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate or moderately slow
Landform: Till plains
Parent material: Glacial till
Slope: 9 to 15 percent
Notes: These soils are highly calcareous.

Taxonomic class: Fine-loamy, mixed, superactive, frigid Typic Eutrochrepts

Typical Pedon:
Langhei loam, 2,250 feet west and 100 feet south of the northeast corner sec. 8, T. 124 N., R. 39 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2), broken face, and very dark grayish brown (10YR 3/2), broken face, loam, gray (10YR 6/1), rubbed, dry; weak fine subangular blocky structure; friable; slight effervescence throughout (HCl, unspecified); 5 percent mixed gravel; moderately alkaline; abrupt smooth boundary.

Bk—6 to 15 inches; grayish brown (2.5Y 5/2), broken face, loam, pale yellow (2.5Y 8/2), broken face, dry; moderate thick platy and weak fine subangular blocky structure; friable; few light gray (2.5Y 7/2) masses of lime pedogenic throughout; strong effervescence throughout (HCl, unspecified); 5 percent mixed gravel; moderately alkaline; abrupt smooth boundary.

C—15 to 60 inches; light olive brown (2.5Y 5/4) loam; massive; friable; few fine prominent grayish brown (10YR 5/2) masses of iron accumulation pedogenic throughout and few fine distinct yellowish brown (10YR 5/4) masses of iron accumulation pedogenic throughout; 5 percent mixed gravel; slight effervescence throughout (HCl, unspecified); moderately alkaline.

Range in Characteristics

10 to 40 inch particle-size control section: averages between 18 and 25 percent clay
Percent rock fragments: 2 to 10 percent in the 10 to 40 inch particle-size control section

Ap horizon:
Chroma: 1 or 2 (cultivated); 1 (uncultivated)

Bk and C horizons:
Texture: loam or clay loam

Lankin Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow
Landform: Till plains
Parent material: Glaciolacustrine deposits over glacial till
Slope: 1 to 3 percent

Taxonomic class: Fine-loamy, mixed, superactive Pachic Udic Haploborolls

Typical pedon:
Lankin loam, 825 feet east and 110 feet north of the southwest corner of sec. 8, T. 156 N., R. 54 W.

A—0 to 11 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium and coarse subangular blocky structure parting to weak very fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common roots throughout; many fine pores; neutral; clear smooth boundary.

Bw1—11 to 17 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak coarse prismatic structure parting to weak and moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few roots; common fine pores; neutral; gradual smooth boundary.

Bw2—17 to 21 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; common fine faint gray (5Y 5/1) and few fine distinct grayish brown (2.5Y 5/2) redoximorphic depletions; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable, slightly sticky and slightly plastic; few roots throughout; common fine pores; slightly alkaline; clear wavy boundary.

2Bw3—21 to 24 inches; very dark grayish brown (2.5Y 3/2) loam, grayish brown (2.5Y 5/2) dry; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; lime concretions around stones and few masses of lime; slight effervescence throughout (HCl, unspecified); 1 percent gravel and 1 percent stones; slightly alkaline; intermittent lenses of sand; clear irregular boundary.

2Bk—24 to 38 inches; light brownish gray (2.5Y 6/2) clay loam, pale yellow (2.5Y 8/2) dry; common medium distinct gray (5Y 5/1) and common fine prominent olive gray (5Y 5/2) redoximorphic depletions and common medium distinct olive brown (2.5Y 4/4) and common fine prominent yellowish brown (10YR 5/4) redoximorphic concentrations; weak fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; violent effervescence throughout (HCl, unspecified); moderately alkaline; about 5 percent rock fragments; gradual wavy boundary.

2C—38 to 60 inches; light olive brown (2.5Y 5/4) clay loam, light yellowish brown (2.5Y 6/4) dry; many medium prominent gray (5Y 5/1) redoximorphic depletions and many medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; massive; very hard, firm, moderately sticky and moderately plastic; slight effervescence throughout (HCl, unspecified); moderately alkaline.

Range in Characteristics

Depth to glacial till: 20 to 40 inches
Notes: A sandy, gravelly, or stony layer is at the contact between the glaciolacustrine deposits and the glacial till in most pedons. Some pedons have a Bk horizon.

Bw horizon:
Texture: loam, silt loam, or clay loam

2Bw horizon:
Notes: Some pedons do not have a 2Bw horizon

2Bk horizons:
Texture: loam or clay loam

2C horizon:
Texture: loam or clay loam
Notes: It contains 2 to 10 percent rock fragments.

Larson Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Slow
Landform: Till plains
Parent material: Glacial till
Slope: 0 to 2 percent
Notes: These soils are sodic.

Taxonomic class: Fine-loamy, mixed, superactive Udic Natriborolls

Typical pedon:
Larson loam, in an area of Cathay-Larson loams, bouldery, 1,700 feet west and 240 feet north of the southeast corner of sec. 6, T. 135 N., R. 58 W.

A—0 to 6 inches; very dark gray (10YR 3/1) bouldery loam, dark gray (10YR 4/1) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; about 1 percent gravel; neutral; abrupt smooth boundary.

E—6 to 10 inches; dark gray (10YR 4/1) bouldery loam, gray (10YR 5/1) dry; moderate fine platy structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; neutral; abrupt irregular boundary.

Btn—10 to 17 inches; very dark gray (10YR 3/1) bouldery clay loam, dark gray (10YR 4/1) dry; strong coarse prismatic structure parting to strong medium subangular blocky; hard, very firm, sticky and plastic; few fine roots; few faint clay films on faces of peds; about 2 percent gravel; neutral; gradual wavy boundary.

Btny—17 to 22 inches; dark grayish brown (2.5Y 4/2) bouldery clay loam, grayish brown (2.5Y 5/2) dry; moderate coarse prismatic structure parting to strong medium subangular blocky; very hard, very firm, sticky and slightly plastic; few faint clay films on faces of peds; about 2 percent gravel; few medium rounded nests of gypsum; few fine irregularly shaped masses and filaments of lime; slight effervescence; slightly alkaline; clear wavy boundary.

Bky—22 to 37 inches; olive brown (2.5Y 4/4) bouldery clay loam, light yellowish brown (2.5Y 6/4) dry; weak medium subangular blocky structure; hard, firm, sticky and slightly plastic; about 3 percent gravel; common large nests of gypsum; many fine irregularly shaped masses of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C—37 to 60 inches; olive brown (2.5Y 4/4) bouldery clay loam, light yellowish brown (2.5Y 6/4) dry; massive; hard, firm, sticky and slightly plastic; about 3 percent gravel; strong effervescence; moderately alkaline.

Range in Characteristics

Notes: Some pedons have a Btk, By, or Bz horizon.

A horizon:
Hue: 10YR or 2.5Y
Value: 2 or 3, 3 to 5 dry

E horizon:
Hue: 10YR or 2.5Y
Value: 2 to 5, 5 to 7 dry
Chroma: 1 to 3

Btn horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 2 to 4, 4 to 6 dry
Chroma: 1 to 3

Bky horizon:
Hue: 2.5Y or 5Y
Value: 4 to 6, 5 to 8 dry
Chroma: 1 to 4

C horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6, 5 to 7 dry
Chroma: 2 to 4
Notes: It is stratified and has layers of coarser or finer textures below a depth of 40 inches in some pedons.

Lemert Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Slow over rapid
Landform: Outwash plains and delta plains
Parent material: Glaciofluvial deposits
Slope: 0 to 1 percent
Notes: These soils are saline-sodic.

Taxonomic class: Coarse-loamy, mixed, superactive Leptic Natriborolls

Typical pedon:
Lemert sandy loam, in an area of Letcher-Lemert sandy loams, 2,420 feet south and 310 feet west of the northeast corner of sec. 28, T. 133 N., R. 53 W.

Ap—0 to 5 inches; very dark gray (10YR 3/1) sandy loam, dark gray (10YR 4/1) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; slight effervescence; slightly alkaline; abrupt smooth boundary.

Btn—5 to 12 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; strong medium prismatic structure parting to strong medium subangular blocky; very hard, very firm,

sticky and slightly plastic; common distinct clay films on faces of peds; slight effervescence; strongly alkaline; clear wavy boundary.

Bkz1—12 to 18 inches; dark grayish brown (2.5Y 4/2) sandy loam, grayish brown (2.5Y 5/2) dry; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm, sticky and slightly plastic; many large rounded nests of salts; common fine irregularly shaped masses of lime; slight effervescence; strongly alkaline; clear wavy boundary.

Bkz2—18 to 27 inches; dark grayish brown (2.5Y 4/2) sandy loam, grayish brown (2.5Y 5/2) dry; moderate medium subangular blocky structure; very hard, very firm, sticky and slightly plastic; very dark grayish brown (10YR 3/2) organic stains on faces of peds; common large rounded nests of salts; many large irregularly shaped masses of lime; strong effervescence; strongly alkaline; clear wavy boundary.

2C1—27 to 34 inches; grayish brown (2.5Y 5/2) fine sand, light brownish gray (2.5Y 6/2) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine rounded masses of lime; slight effervescence; strongly alkaline; gradual wavy boundary.

2C2—34 to 60 inches; grayish brown (2.5Y 5/2) fine sand, light brownish gray (2.5Y 6/2) dry; few fine distinct pale olive (5Y 6/3) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; strongly alkaline.

Range in Characteristics

Depth to sandy material: 20 to 40 inches
Notes: Some pedons have a loam or fine sandy loam E horizon. Some pedons have Bky or Bz horizons. Some pedons do not have a 2C horizon, but have a fine sandy loam C horizon.

Ap horizon:
Value: 2 or 3, 3 to 5 dry

Btn horizon:
Hue: 10YR or 2.5Y
Value: 2 or 3, 3 to 5 dry
Chroma: 1 or 2
Texture: sandy loam, fine sandy loam, or loam

Bkz horizon:
Hue: 2.5Y, 5Y, or neutral
Value: 4 to 7, 5 to 8 dry
Chroma: 0 to 3
Texture: loam or sandy loam

2C horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6, 5 to 7 dry
Chroma: 2 to 4

Letcher Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Slow over moderately rapid
Landform: Outwash plains and delta plains
Parent material: Glaciofluvial deposits
Slope: 0 to 1 percent
Notes: These soils are sodic.

Taxonomic class: Coarse-loamy, mixed, superactive Udic Natriborolls

Typical pedon:
Letcher sandy loam, in an area of Letcher-Lemert sandy loams, 450 feet east and 280 feet south of the northwest corner of sec. 34, T. 133 N., R. 53 W.

Ap—0 to 8 inches; black (10YR 2/1) sandy loam, dark gray (10YR 4/1) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; neutral; abrupt smooth boundary.

E—8 to 17 inches; dark gray (10YR 4/1) loamy fine sand, gray (10YR 6/1) dry; single grain; loose; nonsticky and nonplastic; common very fine roots; neutral; clear irregular boundary.

Btn—17 to 24 inches; dark grayish brown (10YR 4/2) sandy loam, grayish brown (10YR 5/2) dry; strong coarse columnar structure parting to strong medium subangular blocky; extremely hard, friable; slightly sticky and slightly plastic; gray (10YR 6/1) dry coatings of E material on tops of columns; common very fine roots; common faint clay films on faces of peds; few fine irregularly shaped masses of lime; moderately alkaline; abrupt wavy boundary.

BC—24 to 31 inches; dark grayish brown (10YR 4/2) loamy sand, light brownish gray (10YR 6/2) dry; weak coarse subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; slightly alkaline; clear smooth boundary.

C—31 to 60 inches; dark grayish brown (10YR 4/2) loamy fine sand, grayish brown (10YR 5/2) dry; common fine and medium distinct dark yellowish

brown (10YR 3/4) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; slightly alkaline.

Range in Characteristics

Depth to lime: 10 to 25 inches
Notes: Some pedons have a Bk horizon.

Ap horizon:
Value: 2 or 3, 3 to 5 dry

E horizon:
Hue: 10YR or 2.5Y
Value: 3 to 5, 5 to 7 dry
Chroma: 1 or 2
Texture: loamy fine sand, fine sandy loam, or sandy loam
Notes: Some cultivated pedons do not have an E horizon.

Btn horizon:
Hue: 10YR or 2.5Y
Value: 3 or 4, 4 or 5 dry
Chroma: 2 or 3
Texture: sandy loam, fine sandy loam, or loam

C horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 3 to 6, 5 to 7 dry
Chroma: 1 to 4

Lismore Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow
Landform: Till plains
Parent material: Glaciolacustrine deposits over glacial till
Slope: 0 to 6 percent

Taxonomic class: Fine-loamy, mixed Pachic Udic Haploborolls

Typical pedon:
Lismore silty clay loam, in an area of Lismore-Kranzburg silty clay loams, 0 to 2 percent slopes, 1,600 feet east and 300 feet south of the northwest corner of sec. 6, T. 136 N., R. 57 W.

Ap—0 to 10 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; strong coarse angular blocky structure parting to medium coarse subangular blocky; very hard, firm, sticky and plastic; common very fine and fine roots; neutral; abrupt smooth boundary.

A—10 to 17 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate medium prismatic structure parting to moderate coarse angular blocky; very hard, firm, sticky and plastic; common very fine and fine roots; neutral; clear smooth boundary.

2Bw—17 to 27 inches; dark brown (10YR 3/3) clay loam, brown (10YR 5/3) dry; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few very fine roots; about 3 percent gravel; neutral; clear wavy boundary.

2Bk—27 to 36 inches; light olive brown (2.5Y 5/4) loam, light brownish gray (2.5Y 6/2) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; about 3 percent gravel; strong effervescence; moderately alkaline; gradual wavy boundary.

2C—36 to 60 inches; dark grayish brown (2.5Y 4/2) loam, light yellowish brown (2.5Y 6/4) dry; common fine distinct light olive brown (2.5Y 5/6) redoximorphic concentrations; massive; hard, friable, slightly sticky and slightly plastic; about 3 percent gravel; many medium irregularly shaped masses of lime; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 16 to more than 30 inches
Depth to lime: More than 20 inches
Depth to glacial till: 10 to 20 inches

A horizon:
Value: 2 or 3, 3 or 4 dry

2Bw horizon:
Hue: 10YR or 2.5Y
Value: 2 to 4, 3 to 6 dry
Chroma: 1 to 4
Texture: clay loam or loam

2Bk horizon:
Hue: 2.5Y or 5Y
Value: 5 or 6 dry
Texture: clay loam or loam

2C horizon:
Hue: 2.5Y or 5Y
Value: 5 or 6 dry
Texture: clay loam or loam

Lohnes Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Rapid
Landform: Outwash plains
Parent material: Glaciofluvial deposits
Slope: 0 to 3 percent

Taxonomic class: Sandy, mixed Udorthentic Haploborolls

Typical pedon:
Lohnes loamy coarse sand, 2,340 feet north and 75 feet west of the southeast corner of sec. 22, T. 150 N., R. 62 W.

A—0 to 16 inches; black (10YR 2/1) loamy coarse sand, very dark gray (10YR 3/1) dry; weak subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many fine roots; neutral; gradual wavy boundary.

AC—16 to 30 inches; very dark grayish brown (10YR 2/2) loamy coarse sand, dark brown (10YR 4/2) dry; weak medium and fine subangular blocky structure; loose, very friable, slightly sticky and nonplastic; common roots; neutral; gradual wavy boundary.

C1—30 to 47 inches; dark brown (10YR 4/3) coarse sand, brown (10YR 5/3) dry; few fine faint dark yellowish brown (10YR 4/4) moist redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; few very fine roots; slightly alkaline; gradual wavy boundary.

C2—47 to 60 inches; dark grayish brown (2.5Y 4/2) coarse sand, grayish brown (2.5Y 5/2) dry; common fine faint redoximorphic concentrations in upper part, common fine distinct brownish yellow (10YR 6/6) redoximorphic concentrations in lower part; single grain; loose; nonsticky and nonplastic; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 10 to 20 inches
Depth to lime: 10 to 60 inches
10 to 40 inch particle-size control section: It is coarse sand, sand, loamy sand, or loamy coarse sand. It averages less than 5 percent rock fragments.
Notes: Some pedons have a Bw horizon.

A horizon:
Value: 2 or 3, 3 to 5 dry
Texture: coarse sand, sand, loamy coarse sand, loamy sand, coarse sandy loam, or sandy loam

C horizon:
Value: 3 to 6, 4 to 7 dry
Chroma: 2 or 3
Texture: coarse sand, sand, loamy coarse sand, or loamy sand

Maddock Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Rapid
Landform: Delta plains
Parent material: Glaciofluvial and eolian deposits
Slope: 1 to 15 percent

Taxonomic class: Sandy, mixed Udorthentic Haploborolls

Typical pedon:
Maddock loamy fine sand, in an area of Maddock-Hecla loamy fine sands, 1 to 6 percent slopes, 1,220 feet west and 150 feet north of the southeast corner of sec. 24, T. 135 N., R. 54 W.

A—0 to 10 inches; black (10YR 2/1) loamy fine sand, very dark gray (10YR 3/1) dry; weak fine granular structure parting to single grain; loose; nonsticky and nonplastic; many very fine and few fine roots; neutral; clear wavy boundary.

Bw—10 to 14 inches; dark brown (10YR 3/3) fine sand, brown (10YR 4/3) dry; single grain; loose; nonsticky and nonplastic; common very fine roots; neutral; clear wavy boundary.

C1—14 to 26 inches; dark yellowish brown (10YR 3/4) fine sand, dark yellowish brown (10YR 4/4) dry; single grain; loose; nonsticky and nonplastic; common very fine roots; neutral; clear wavy boundary.

C2—26 to 43 inches; dark yellowish brown (10YR 4/4) fine sand, yellowish brown (10YR 5/4) dry; single grain; loose; nonsticky and nonplastic; few very fine roots; slightly alkaline; gradual wavy boundary.

C3—43 to 60 inches; dark yellowish brown (10YR 4/4) fine sand, yellowish brown (10YR 5/4) dry; few fine faint dark yellowish brown (10YR 3/4) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; slightly alkaline.

Range in Characteristics

Mollic epipedon thickness: 10 to 16 inches
Depth to lime: 30 inches or more
Notes: Some pedons have an AC horizon.

A horizon:
Value: 2 or 3, 3 to 5 dry

Bw horizon:
Value: 2 to 5, 4 to 6 dry
Chroma: 2 to 4
Texture: fine sand or loamy fine sand
Notes: Some pedons do not have a Bw horizon.

C horizon:
Hue: 10YR or 2.5Y
Value: 3 to 6, 4 to 7 dry
Chroma: 2 to 4
Notes: It has a small amount of gravel in some pedons.

Marysland Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderate over rapid
Landform: Outwash plains
Parent material: Glaciofluvial deposits
Slope: 0 to 1 percent
Notes: These soils are highly calcareous.

Taxonomic class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Typic Calciaquolls

Typical pedon:
Marysland silt loam, 2,050 feet south and 200 feet west of the northeast corner of sec. 32, T. 136 N., R. 58 W.

A—0 to 8 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

Ak—8 to 14 inches; very dark gray (N 3/0) silt loam, dark gray (N 4/0) dry; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

Bk—14 to 22 inches; dark gray (N 4/0) loam, gray (N 5/0) dry; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; violent effervescence; moderately alkaline; gradual wavy boundary.

2C1—22 to 30 inches; grayish brown (2.5Y 5/2) loamy sand, light brownish gray (2.5Y 6/2) dry; common medium distinct light olive brown (2.5Y 5/6) redoximorphic concentrations; single grain; loose; slightly sticky and nonplastic; slight effervescence; moderately alkaline; gradual wavy boundary.

2C2—30 to 36 inches; grayish brown (2.5Y 5/2) coarse sand, light gray (2.5Y 7/2) dry; many medium prominent dark yellowish brown (10YR 4/4) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; slight effervescence; moderately alkaline; gradual wavy boundary.

2C3—36 to 60 inches; grayish brown (2.5Y 5/2) gravelly coarse sand, light gray (2.5Y 7/2) dry; single grain; loose; nonsticky and nonplastic; about 20 percent gravel; slight effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 30 inches
Depth to sand and gravel: 20 to 40 inches
Notes: Some pedons have a C horizon.

A horizon:
Hue: 10YR, 2.5Y, or neutral
Chroma: 0 to 1

Bk horizon:
Hue: 10YR, 2.5Y, 5Y, or neutral
Value: 3 to 6, 4 to 7 dry
Chroma: 0 to 2
Texture: loam, clay loam, or sandy clay loam

2C horizon:
Hue: 2.5Y or 5Y
Value: 3 to 6
Chroma: 1 or 2

Minnewaukan Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Rapid
Landform: Lake plains
Parent material: Glaciofluvial deposits
Slope: 0 to 3 percent

Taxonomic class: Mixed, frigid Typic Psammaquents

Typical pedon:
Minnewaukan loamy fine sand, 1,055 feet south and 150 feet west of the northeast corner of sec. 17, T. 151 N., R. 63 W.

A—0 to 3 inches; black (10YR 2/1) loamy fine sand, dark gray (10YR 4/1) dry; weak fine subangular blocky and granular structure; soft, very friable, slightly sticky and nonplastic; many roots; about 1 percent gravel; slight effervescence; slightly alkaline; abrupt smooth boundary.

AC—3 to 5 inches; dark grayish brown and very dark grayish brown (2.5Y 4/2 and 2.5Y 3/2) loamy coarse sand, grayish brown (2.5Y 5/2) dry; single grain; nonsticky and nonplastic; many roots; about 15 percent gravel; slight effervescence; slightly alkaline; clear smooth boundary.

C—5 to 16 inches; dark grayish brown with olive brown (2.5Y 4/2 with 2.5Y 4/4) loamy sand, light brownish gray (2.5Y 6/2) dry; many fine distinct dark yellowish brown (10YR 4/4) redoximorphic concentrations; weak coarse prismatic structure parting to weak medium subangular blocky; soft, very friable, slightly sticky and nonplastic; few roots; about 1 percent gravel; slight effervescence; slightly alkaline; clear wavy boundary.

Cg1—16 to 28 inches; olive gray and olive (5Y 4/2 and 5Y 4/3) loamy sand, light gray and light olive gray (5Y 6/1 and 5Y 6/2) dry; very weak coarse prismatic structure; slightly sticky and nonplastic; few fine roots; about 10 percent pebbles; about 30 percent of sand and pebbles are shale fragments; few fine masses of lime; slight effervescence; slightly alkaline; clear wavy boundary.

Cg2—28 to 36 inches; olive gray and gray (5Y 5/2 and 5Y 5/1) fine sand, light gray (5Y 7/2) dry; single grain; nonsticky and nonplastic; about 1 percent gravel; slight effervescence; slightly alkaline; clear smooth boundary.

Cg3—36 to 50 inches; dark brown (10YR 3/3) fine sand, brown (10YR 4/3 and 10YR 5/3) dry; single grain; nonsticky and nonplastic; few small iron and manganese concretions; slight effervescence; moderately alkaline.

Cg4—50 to 60 inches; olive (5Y 4/3) fine sand, pale olive (5Y 6/3) dry; single grain; nonsticky and nonplastic; slight effervescence; moderately alkaline.

Range in Characteristics

10 to 40 inch particle-size control section: loamy fine sand, loamy sand, fine sand, or sand
Notes: Some pedons have horizons that contain 1 to 20 percent gravel.
A and AC horizons:
Hue: 10YR, 2.5Y, or 5Y
Value: 3 to 6 dry
Texture: ranges from fine sandy loam to sand
C horizon:
Hue: 10YR, 2.5Y, 5Y, or 5GY

Nutley Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope: 0 to 25 percent
Notes: These soils are calcareous.

Taxonomic class: Fine, smectitic, frigid Chromic Hapluderts

Typical pedon:
Nutley silty clay, 360 feet south and 250 feet east of the northwest corner of sec. 8, T. 121 N., R. 58 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay, dark gray (10YR 4/1) dry; moderate fine granular structure; slightly hard, friable, moderately sticky and moderately plastic; slight effervescence throughout (HCl, unspecified); moderately alkaline; abrupt smooth boundary.

Bss—7 to 20 inches; dark grayish brown (2.5Y 4/2) clay, light brownish gray (2.5Y 6/2) dry; weak coarse prismatic structure parting to moderate very fine and fine angular blocky; hard, firm, moderately sticky and moderately plastic; slight

effervescence throughout (HCl, unspecified); moderately alkaline; few intersecting slickensides; gradual wavy boundary.

Css—20 to 48 inches; olive (5Y 5/3) clay, pale yellow (5Y 7/3) dry; common fine prominent yellowish red (5YR 4/6) redoximorphic concentrations and common fine distinct gray (5Y 5/1) redoximorphic depletions; weak fine angular blocky structure; very hard, firm, very sticky and moderately plastic; strong effervescence throughout (HCl, unspecified); moderately alkaline; fine tongues of dark gray (10YR 4/1) and black (10YR 2/1); few intersecting slickensides; diffuse wavy boundary .

C—48 to 60 inches; olive (5Y 5/3) clay, pale yellow (5Y 7/3) dry; many medium prominent yellowish red (5YR 4/6) redoximorphic concentrations and many medium distinct gray (5Y 5/1) redoximorphic depletions; weak fine and medium angular blocky structure; very hard, firm, very sticky and moderately plastic; strong effervescence throughout (HCl, unspecified); moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 16 inches
Depth to lime: 0 to 10 inches
10 to 40 inch particle-size control section: Silty clay, silty clay loam, or clay
Notes: When the soil is dry, cracks 1/2 to 2 inches wide and several feet long extend downward through the B horizon. Some pedons have a BC or Bk horizon.

Ap horizon:
Texture: silty clay loam, silty clay, clay, or clay loam

Bss horizon:
Texture: clay, silty clay, or silty clay loam

C horizon:
Texture: clay, silty clay, or silty clay loam
Notes: It has gypsum in some pedons.

Overly Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope: 0 to 1 percent

Typical pedon:
Overly silty clay loam, 2,380 feet south and 500 feet west of the northeast corner of sec. 17, T. 135 N., R. 54 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; strong coarse subangular blocky structure parting to moderate medium granular; very hard, friable, sticky and plastic; many fine and very fine roots; neutral; abrupt smooth boundary.

A—8 to 17 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; strong coarse subangular blocky structure; very hard, friable, sticky and plastic; common fine and very fine roots; neutral; clear smooth boundary.

Bw1—17 to 30 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate medium prismatic structure parting to moderate fine angular blocky; very hard, firm; sticky and plastic; few very fine roots; neutral; clear wavy boundary.

Bw2—30 to 39 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 4/3) dry; moderate medium prismatic structure parting to moderate fine subangular blocky; very hard, firm, sticky and plastic; neutral; gradual wavy boundary.

Bk1—39 to 48 inches; brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) dry; moderate medium angular blocky structure; hard, friable, slightly sticky and slightly plastic; common medium irregularly shaped masses of lime; strong effervescence; moderately alkaline; clear wavy boundary.

Bk2—48 to 56 inches; grayish brown (2.5Y 5/2) silty clay loam, light gray (2.5Y 7/2) dry; few fine prominent yellowish red (5YR 5/6) redoximorphic concentrations; moderate medium angular blocky structure; hard, friable, slightly sticky and slightly plastic; common medium irregularly shaped masses of lime; strong effervescence; moderately alkaline; clear wavy boundary.

C—56 to 60 inches; grayish brown (2.5Y 5/2) silt loam, light gray (2.5Y 7/2) dry; many medium prominent yellowish red (5YR 5/8) redoximorphic concentrations; massive; slightly hard and very friable; slightly sticky and slightly plastic; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 16 to 40 inches

A horizon:
Value: 2 or 3, 3 or 4 dry

Bw horizon:
Hue: 10YR or 2.5Y
Value: 2 to 4, 4 or 5 dry
Chroma: 1 to 3

Bk horizon:
Value: 3 to 6, 4 to 7 dry
Chroma: 2 to 4

C horizon:
Hue: 2.5Y or 5Y
Value: 4 to 6, 6 or 7 dry
Chroma: 2 to 4
Texture: silty clay loam or silt loam
Notes: It has strata of sand below a depth of 40 inches in some pedons.

Parnell Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Slow
Landform: Till plains
Parent material: Alluvium
Slope: 0 to 1 percent

Taxonomic class: Fine, smectitic, frigid Vertic Argiaquolls

Typical pedon:
Parnell silty clay loam, 2,300 feet south and 1,710 feet west of the northeast corner of sec. 8, T. 133 N., R. 56 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure parting to weak fine granular; hard, firm, sticky and plastic; many fine and very fine and common medium roots; neutral; abrupt smooth boundary.

A—7 to 17 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate medium prismatic structure parting to moderate coarse subangular blocky; hard, friable, slightly sticky and plastic; common fine and very fine and few medium roots; coatings of clean sand and silt of faces of peds; slightly acid; clear wavy boundary.

Btg1—17 to 24 inches; black (5Y 2/1) silty clay, dark gray (5Y 4/1) dry; moderate medium prismatic structure parting to strong medium angular blocky; very hard, firm, sticky and plastic; common fine and many very fine roots; few faint clay films on faces of peds; slightly acid; gradual smooth boundary.

Btg2—24 to 38 inches; black (5Y 2/1) silty clay, dark gray (5Y 4/1) dry; few fine distinct olive (5Y 5/4) redoximorphic concentrations; weak medium prismatic structure parting to weak medium subangular blocky; very hard, very firm, sticky and plastic; common very fine roots; few faint clay film on faces of peds; neutral; gradual wavy boundary.

Btg3—38 to 60 inches; black (5Y 2/1) silty clay, gray (5Y 5/1) dry; few fine distinct olive (5Y 5/4) redoximorphic concentrations; weak medium subangular blocky structure; very hard, very firm, sticky and plastic; few faint clay films on faces of peds; neutral.

Range in Characteristics

Mollic epipedon thickness: 24 to more than 60 inches
Depth to lime: 35 to more than 60 inches
Notes: Some pedons have an O horizon up to 6 inches thick. Some pedons have a Cg horizon.

A horizon:
Hue: 10YR, 2.5Y, 5Y, or neutral
Value: 2 or 3
Chroma: 0 or 1

Btg horizon:
Hue: 2.5Y or 5Y
Value: 2 to 4
Chroma: 1 or 2
Texture: silty clay, silty clay loam, or clay loam

Peever Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Slow
Landform: Till plains
Parent material: Glacial till
Slope: 0 to 6 percent

Taxonomic class: Fine, smectitic Udic Argiborolls

Typical pedon:
Peever clay loam, in an area of Peever-Gwinner complex, 3 to 6 percent slopes, 2,190 feet west and 150 feet south of the northeast corner of sec. 23, T. 134 N., R. 57 W.

Ap—0 to 8 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; about 2 percent gravel; neutral; abrupt smooth boundary.

Bt1—8 to 15 inches; dark grayish brown (10YR 4/2) clay loam, grayish brown (10YR 5/2) dry; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, slightly sticky and plastic; few very fine roots; common distinct clay films on faces of peds; 1/4 to 1-inch black (10YR 2/1) tongues of A horizon; about 1 percent gravel; neutral; clear irregular boundary.

Bt2—15 to 20 inches; dark grayish brown (2.5Y 4/2) clay, grayish brown (2.5Y 5/2) dry; strong medium prismatic structure parting to strong fine angular blocky; very hard, very firm, sticky and plastic; many prominent clay films on faces of peds; about 1 percent gravel; slightly alkaline; clear wavy boundary.

Bk1—20 to 34 inches; light olive brown (2.5Y 5/4) clay loam, pale yellow (2.5Y 7/4) dry; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, slightly sticky and slightly plastic; about 3 percent gravel; common fine irregularly shaped masses of lime; violent effervescence; moderately alkaline; gradual wavy boundary.

Bk2—34 to 43 inches; olive brown (2.5Y 4/4) clay loam, light yellowish brown (2.5Y 6/4) dry; few fine prominent gray (5Y 5/1) relict redoximorphic depletions and common fine prominent strong brown (7.5YR 4/6) relict redoximorphic concentrations; weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; about 3 percent gravel; few fine irregularly shaped nests of gypsum; few fine irregularly shaped masses of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C—43 to 60 inches; dark grayish brown (2.5Y 4/2) clay loam, light brownish gray (2.5Y 6/2) dry; common fine prominent gray (5Y 5/1) relict redoximorphic depletions and few fine prominent strong brown (7.5YR 4/6) relict redoximorphic concentrations; massive; hard, friable, slightly sticky and slightly plastic; about 3 percent gravel; common fine irregularly shaped masses of lime; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 16 inches

Ap horizon:
Value: 2 or 3, 3 or 4 dry

Bt horizon:
Value: 2 to 4, 4 to 6 dry
Chroma: 1 to 3
Texture: clay, clay loam, or silty clay

Bk horizon:
Value: 4 to 6, 5 to 7 dry
Texture: clay loam or clay

C horizon:
Value: 4 to 6, 5 to 7 dry
Texture: clay loam or clay
Notes: It has few to common nests of gypsum in many pedons.

Perella Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderately slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope: 0 to 1 percent

Taxonomic class: Fine-silty, mixed, superactive, frigid Typic Endoaquolls

Typical pedon:
Perella silty clay loam, 1,390 feet north and 300 feet west of southeast corner of sec. 31, T. 162 N., R. 51 W.

A1—0 to 9 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; moderate very fine angular blocky structure; very hard, very friable, sticky and slightly plastic; many roots; many pores, neutral; clear irregular boundary.

A2—9 to 14 inches; very dark gray (5Y 3/1) silty clay loam, dark gray (5Y 4/1) dry; few fine prominent light olive brown (2.5Y 5/6) redoximorphic concentrations; moderate very

fine angular blocky structure; very hard, very friable, sticky and slightly plastic; many roots; many pores; neutral; clear wavy boundary.

Bg1—14 to 18 inches; very dark gray (5Y 3/1) silty clay loam, gray (5Y 5/1) dry; many fine prominent dark yellowish brown (10YR 4/4) and distinct olive (5Y 4/3) redoximorphic concentrations; strong fine and very fine angular blocky structure; hard, friable, sticky and plastic; common roots; many fine pores, neutral; gradual wavy boundary.

Bg2—18 to 24 inches; dark gray (5Y 4/1) silty clay loam, gray (5Y 5/1) dry; many fine prominent dark reddish brown (5YR 3/3) and many fine distinct olive (5Y 5/4) redoximorphic concentrations; moderate medium and thin platy structure; hard, friable, sticky and plastic; few roots; many fine pores; slightly alkaline; clear wavy boundary.

Cg1—24 to 30 inches; olive gray (5Y 5/2) silt loam, light gray (5Y 7/2) dry; many fine prominent strong brown (7.5YR 5/6) and dark reddish brown (5YR 3/4) and many large prominent dark reddish brown (5YR 2/2) redoximorphic concentrations; moderate medium and thin platy structure; hard, friable, slightly sticky and slightly plastic; few roots; common fine pores, slightly alkaline; gradual wavy boundary.

Cg2—30 to 52 inches; gray (5Y 6/1) silt loam, light gray (5Y 7/1) dry; many fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; massive; hard, friable, slightly sticky and slightly plastic; few medium pores; many small iron-manganese accumulations; slight effervescence; moderately alkaline; gradual wavy boundary.

Cg3—52 to 60 inches; light olive brown (2.5Y 5/4) silty clay loam, pale yellow (2.5Y 7/4) dry; many medium prominent gray (5Y 6/1) redoximorphic depletions and many fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; massive; hard, friable, sticky and plastic; few soft small iron accumulations; slight effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 10 to 24 inches
Depth to lime: 16 to 36 inches
Notes: Some pedons have a Bkg horizon below a depth of 16 inches.

A horizon:
Hue: 10YR, 2.5Y, 5Y, or neutral
Texture: silt loam or silty clay loam

Bg horizon:
Hue: 10YR, 2.5Y, 5Y, or neutral
Value: 2 to 4, 3 to 6 dry
Chroma: 0 to 3
Texture: silt loam or silty clay loam

Cg horizon:
Value: 4 to 6, 5 to 7 dry
Texture: silt, silt loam, or silty clay loam

Rauville Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderately slow over moderately rapid
Landform: Flood plains
Parent material: Alluvium
Slope: 0 to 1 percent
Notes: These soils are calcareous.

Taxonomic class: Fine-silty, mixed, superactive, calcareous, frigid Cumulic Endoaquolls

Typical pedon:
Rauville silty clay loam, 1,530 feet west and 600 feet north of the southeast corner of sec. 11, T. 134 N., R. 56 W.

A—0 to 2 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

Ag—2 to 40 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; weak fine granular structure; hard, friable, sticky and plastic; common fine and medium roots; slight effervescence; moderately alkaline; clear wavy boundary.

2Cg1—40 to 44 inches; dark gray (5Y 4/1) fine sandy loam, light gray (5Y 6/1) dry; common fine prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; massive; slightly hard, very friable, slightly sticky and nonplastic; few fine roots; slight effervescence; moderately alkaline; clear wavy boundary.

2Cg2—44 to 48 inches; dark gray (5Y 4/1) fine sandy loam, light gray (5Y 6/1) dry; many medium prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; single grain; slightly hard, very friable, slightly sticky and slightly plastic; slight effervescence; moderately alkaline; clear wavy boundary.

3Cg3—48 to 60 inches; dark gray (5Y 4/1) gravelly sandy loam, light gray (5Y 6/1) dry; common medium prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; about 20 percent rock fragments; slight effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 24 to more than 60 inches
Depth to loamy material: 40 to 60 inches
Notes: Some pedons have an O horizon.

A horizon:
Hue: 10YR, 2.5Y, 5Y, or neutral
Value: 2 or 3, 3 to 5 dry
Chroma: 0 to 2

2Cg and 3Cg horizons:
Hue: 2.5Y or 5Y
Value: 4 to 6, 5 to 8 dry
Chroma: 1 to 4

Renshaw Series

Depth class: Very deep
Drainage class: Somewhat excessively drained
Permeability: Moderate over very rapid
Landform: Outwash plains and terraces
Parent material: Glaciofluvial deposits
Slope: 0 to 6 percent

Taxonomic class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive Udic Haploborolls

Typical pedon:
Renshaw loam, in an area of Renshaw-Sioux complex, 0 to 6 percent slopes, 660 feet south and 1,060 feet west of the northeast corner of sec. 16, T. 136 N., R. 58 W. (fig. 9)

Ap—0 to 7 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; slightly hard, very friable; slightly sticky and slightly

Figure 9. Typical pedon of Renshaw loam.

plastic; many very fine roots; neutral; abrupt smooth boundary.

Bw—7 to 15 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; neutral; clear wavy boundary.

2C—15 to 60 inches; yellowish brown (10YR 5/4) gravelly sand, light yellowish brown (10YR 6/4) dry; single grain; loose; nonsticky and nonplastic; about 25 percent gravel; slight effervescence; slightly alkaline.

Range in Characteristics

Mollic epipedon thickness: 10 to 16 inches
Depth to sand and gravel: 14 to 20 inches

Ap horizon:
Value: 2 or 3, 3 or 4 dry

Bw horizon:
Value: 3 or 4, 3 to 5 dry
Chroma: 1 to 3
Texture: loam or gravelly loam

Rifle Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderately rapid
Landform: Low terraces
Parent material: Organic deposits
Slope: 0 to 1 percent

Taxonomic class: Euic Typic Borohemists

Typical pedon:
Rifle mucky peat, 2,000 feet west and 830 feet south of the northeast corner of sec. 12, T. 135 N., R. 53 W.

Oe—0 to 9 inches; very dark gray (10YR 3/1) broken face, black (10YR 2/1) broken face and rubbed mucky peat; about 60 percent fibers, 18 percent rubbed; massive; nonsticky and nonplastic; few coarse, common medium, and many fine and very fine roots; few shell fragments; very slight effervescence; slightly alkaline; clear wavy boundary.

Oa1—9 to 13 inches; very dark brown (10YR 2/2) broken face, black (10YR 2/1) rubbed, muck; about 50 percent fiber, 10 percent rubbed; massive; nonsticky and nonplastic; common fine and many very fine roots; few shell fragments; very slight effervescence; slightly alkaline; clear smooth boundary.

Oa2—13 to 20 inches; very dark brown (10YR 2/2) and grayish brown (10YR 5/2) broken face, and black (10YR 2/1) rubbed, muck; about 70 percent fiber, 10 percent rubbed; massive; nonsticky and nonplastic; common fine and very fine roots; common shell fragments; strong effervescence; slightly alkaline; clear smooth boundary.

O'e1—20 to 27 inches; dark brown (7.5YR 3/4) broken face, black (10YR 2/1) rubbed, mucky peat; about 80 percent fiber, 25 percent rubbed; massive; nonsticky and nonplastic; few very fine roots; neutral; gradual smooth boundary.

O'e2—27 to 50 inches; dark brown (7.5YR 3/4) broken face, black (10YR 2/1) rubbed, mucky peat; about 90 percent fiber, 30 percent rubbed; massive; nonsticky and nonplastic; neutral; gradual smooth boundary.

O'e3—50 to 60 inches; dark brown (7.5YR 3/4) broken face, black (10YR 2/1) rubbed, mucky peat; about 85 percent fiber, 25 percent rubbed; nonsticky and nonplastic; massive; neutral.

Range in Characteristics

Thickness of organic materials: More than 51 inches
Notes: The organic material is primarily woody and herbaceous fibers. Some pedons contain surface layers composed of sapric material.

Oe horizon:
Value: 2 to 4 broken face, 2 or 3 rubbed
Chroma: 1 to 4 broken face, 1 rubbed

Oa horizon:
Value: 2 to 5 broken face, 2 or 3 rubbed
Chroma: 1 or 2 broken face, 1 rubbed

Rosewood Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderately rapid
Landform: Delta plains
Parent material: Glaciofluvial deposits
Slope: 0 to 1 percent
Notes: These soils are highly calcareous.

Taxonomic class: Sandy, mixed, frigid Typic Calciaquolls

Typical pedon:
Rosewood fine sandy loam, 580 feet west and 290 feet north of the southeast corner of sec. 24, T. 133 N., R. 53 W.

A1—0 to 8 inches; black (10YR 2/1) fine sandy loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; many very fine roots; slight effervescence; slightly alkaline; gradual smooth boundary.

A2—8 to 14 inches; black (10YR 2/1) fine sandy loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; many fine roots; slight effervescence; slightly alkaline; abrupt wavy boundary.

Bkg1—14 to 19 inches; gray (5Y 5/1) fine sandy loam, light gray (5Y 6/1) dry; few fine distinct olive (5Y 5/3) redoximorphic concentrations; weak medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; common fine roots; violent effervescence; moderately alkaline; clear wavy boundary.

Bkg2—19 to 27 inches; grayish brown (2.5Y 5/2) fine sand, light brownish gray (2.5Y 6/2) dry; common fine distinct light olive brown (2.5Y 5/4) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg—27 to 60 inches; grayish brown (2.5Y 5/2) fine sand, light brownish gray (2.5Y 6/2) dry; many medium prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; slight effervescence; slightly alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 16 inches
Depth to loamy fine sand and coarser material: Less than 20 inches

A horizon:
Hue: 10YR, 2.5Y, or neutral
Value: 2 or 3
Chroma: 0 to 2

Bkg horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6
Texture: fine sandy loam, sandy loam, loamy fine sand, fine sand, or loamy sand

Cg horizon:
Hue: 2.5Y or 5Y
Value: 4 to 7
Chroma: 1 or 2

Ryan Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Very slow
Landform: Flood plains
Parent material: Alluvium
Slope: 0 to 1 percent
Notes: These soils are saline-sodic.

Taxonomic class: Fine, smectitic, frigid Typic Natraquerts

Typical pedon:
Ryan silty clay, 1,810 feet south and 1,735 feet west of the northeast corner of sec. 36, T. 132 N., R. 60 W.

E—0 to 2 inches; black (10YR 2/1) silty clay, dark gray (10YR 4/1) dry; weak thin platy and weak thin angular blocky structure; very hard, firm, moderately sticky and moderately plastic; common fine roots throughout; moderately alkaline; abrupt smooth boundary.

Btn1—2 to 4 inches; black (10YR 2/1) silty clay, dark gray (5Y 4/1) dry; strong medium and coarse columnar structure parting to strong fine angular blocky; very hard, firm, very sticky and very plastic; few fine roots throughout; many faint clay films on faces of peds; strongly alkaline; clear smooth boundary; top of columns coated with gray (5Y 5/1) silt coatings; many faint clay films on faces of peds.

Btn2—4 to 8 inches; black (10YR 2/1) silty clay, dark gray (5Y 4/1) dry; moderate medium and coarse prismatic structure parting to strong fine angular blocky; very hard, firm, very sticky and very plastic; common fine roots throughout; many faint clay films on faces of peds; slight effervescence throughout

(HCl, unspecified); strongly alkaline; clear wavy boundary.

Bg1—8 to 22 inches; black (10YR 2/1) silty clay, dark gray (N 4/0) dry; weak coarse prismatic structure parting to moderate fine subangular blocky; very hard, firm, very sticky and very plastic; few fine roots throughout; strong effervescence throughout (HCl, unspecified); strongly alkaline; few lime masses; gradual wavy boundary.

Bg2—22 to 36 inches; black (10YR 2/1) silty clay, dark gray (N 4/0) dry; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, very sticky and very plastic; strong effervescence throughout (HCl, unspecified); strongly alkaline; few lime masses; common fine salt crystals; gradual wavy boundary.

Cg—36 to 60 inches; very dark gray (5Y 3/1) silty clay, gray (N 5/0) dry; massive; very hard, firm, very sticky and very plastic; strong effervescence throughout (HCl, unspecified); strongly alkaline; common fine gypsum crystals; few fine lime masses.

Range in Characteristics

Mollic epipedon thickness: 20 to 50 inches
Depth to lime: 0 to 10 inches
Notes: Where uncultivated, the combined thickness of the A and E horizons is less than 5 inches. Some pedons have a Btnz, Bk, or Bkz horizon. Coarser textured deposits are below a depth of 40 inches in some pedons.

E horizon:
Texture: loam, silt loam, silty clay loam, or silty clay

Btn horizon:
Texture: clay or silty clay

Bg and Cg horizons:
Texture: silty clay, clay, or silty clay loam

Serden Series

Depth class: Very deep
Drainage class: Excessively drained
Permeability: Rapid
Landform: Delta plains
Parent material: Eolian deposits
Slope: 1 to 35 percent

Taxonomic class: Mixed, frigid Typic Udipsamments

Typical pedon:
Serden fine sand, in an area of Serden-Duneland complex, 1 to 35 percent slopes, 1,050 feet north and 1,130 feet west of the southeast corner of sec. 35, T. 136 N., R. 53 W.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) fine sand, dark grayish brown (10YR 4/2) dry; single grain; loose; nonsticky and nonplastic; many fine and very fine roots; neutral; clear wavy boundary.

C1—5 to 14 inches; dark brown (10YR 4/3) fine sand, brown (10YR 5/3) dry; single grain; loose; nonsticky and nonplastic; common fine and very fine roots; neutral; clear smooth boundary.

C2—14 to 60 inches; dark yellowish brown (10YR 4/4) fine sand, yellowish brown (10YR 5/4) dry; single grain; loose; nonsticky and nonplastic; neutral.

Range in Characteristics

Depth to lime: 36 to more than 60 inches

A horizon:
Value: 2 to 4, 3 to 6 dry
Chroma: 1 or 2

C horizon:
Hue: 10YR or 2.5Y
Value: 3 to 6, 5 to 7 dry
Chroma: 2 to 4

Sioux Series

Depth class: Very deep
Drainage class: Excessively drained
Permeability: Very rapid
Landform: Outwash plains, till plains, and moraines
Parent material: Glaciofluvial deposits
Slope: 0 to 15 percent

Taxonomic class: Sandy-skeletal, mixed Udorthentic Haploborolls

Typical pedon:
Sioux sandy loam, in an area of Renshaw-Sioux complex, 0 to 6 percent slopes, 630 feet south and 1,760 feet west of the northeast corner of sec. 6, T. 133 N., R. 54 W.

Ap—0 to 7 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; common very fine roots; about 3 percent gravel; slightly alkaline; abrupt smooth boundary.

Bk—7 to 24 inches; dark grayish brown (10YR 4/2) very gravelly loamy coarse sand, grayish brown (10YR 5/2) dry; single grain; loose; nonsticky and nonplastic; about 45 percent gravel; lime on undersides of pebbles; slight effervescence; slightly alkaline; gradual wavy boundary.

C—24 to 60 inches; brown (10YR 4/3) very gravelly coarse sand, pale brown (10YR 6/3) dry; single grain; loose; nonsticky and nonplastic; about 40 percent gravel; slight effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 14 inches
Depth to lime: 3 to 8 inches
Depth to sand and gravel: 6 to 14 inches
Notes: Some pedons have lime to the surface. Some pedons have an AC horizon

Ap horizon:
Value: 2 or 3, 3 to 5 dry
Texture: sandy loam or cobbly sandy loam

C horizon:
Hue: 10YR or 2.5Y
Value: 4 to 6, 5 to 7 dry
Chroma: 2 to 4

Southam Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Slow
Landform: Till plains
Parent material: Alluvium
Slope: 0 to 1 percent
Notes: These soils are calcareous.

Taxonomic class: Fine, smectitic, calcareous, frigid Cumulic Vertic Endoaquolls

Typical pedon:
Southam silt loam, 1,300 feet north and 1,240 feet west of the southeast corner of sec. 29, T. 133 N., R. 58 W.

Ag1—0 to 8 inches; black (5Y 2/1) silt loam, dark gray (5Y 4/1) dry; weak fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine snail shell fragments; slight effervescence; slightly alkaline; clear wavy boundary.

Ag2—8 to 15 inches; black (5Y 2/2) silty clay loam, olive gray (5Y 4/2) dry; massive; very hard, very firm; sticky and plastic; common fine snail shell fragments; strong effervescence; slightly alkaline; gradual wavy boundary.

Ag3—15 to 33 inches; black (5Y 2/2) silty clay, dark gray (5Y 4/1) dry; few fine prominent light olive brown (2.5Y 5/4) redoximorphic concentrations; massive; extremely hard, very firm, very sticky and very plastic; common fine snail shell fragments; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg1—33 to 47 inches; olive gray (5Y 4/2) silty clay, gray (5Y 6/1) dry; common fine prominent light yellowish brown (2.5Y 6/4) redoximorphic concentrations; massive; extremely hard, very firm, very sticky and very plastic; many fine snail shell fragments; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg2—47 to 60 inches; dark gray (5Y 4/1) silty clay, gray (5Y 6/1) dry; many fine prominent light yellowish brown (2.5Y 6/4) redoximorphic concentrations; massive; extremely hard, very firm, very sticky and very plastic; many fine snail shell fragments; strong effervescence; moderately alkaline.

Range in Characteristics

Depth to lime: 0 to 10 inches
Notes: Some pedons have an O horizon up to 6 inches thick. Some pedons have a 2C horizon.

Ag horizon:
Hue: 10YR, 2.5Y, 5Y, or neutral
Value: 2 or 3, 3 to 5 dry
Chroma: 0 to 2

Cg horizon:
Hue: 2.5Y, 5Y, 5GY, or neutral
Value: 3 to 7, 4 to 8 dry
Chroma: 0 to 2
Texture: silty clay, silty clay loam, or clay

Spottswood Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderate over very rapid
Landform: Outwash plains
Parent material: Glaciofluvial deposits
Slope: 0 to 3 percent

Taxonomic class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive Pachic Udic Haploborolls

Typical pedon:
Spottswood loam, 390 feet north and 950 feet east of the southwest corner of sec. 19, T. 110 N., R. 50 W.

Ap—0 to 10 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure parting to moderate fine and medium granular; hard, friable, slightly sticky and slightly plastic; common very fine and few fine roots; common very fine pores; common fine worm casts; 2 percent subrounded gravel; neutral; abrupt smooth boundary.

Bw1—10 to 17 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine and few fine roots; common very fine pores; common fine worm casts; 1 percent subrounded gravel; neutral; gradual wavy boundary.

Bw2—17 to 22 inches; olive brown (2.5Y 4/3) sandy loam, light olive brown (2.5Y 5/3) dry; weak coarse prismatic structure parting to moderate coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine pores; common discontinuous black (10YR 2/1) organic coats on faces of peds; 11 percent subrounded gravel; slightly alkaline; clear wavy boundary.

BC—22 to 26 inches; olive brown (2.5Y 4/3) sandy loam, light olive brown (2.5Y 5/3) dry; common fine prominent yellowish brown (10YR 5/6 and 10YR 5/4) iron masses; weak coarse subangular blocky structure; slightly hard, very friable; few fine roots; common fine pores; few discontinuous black (10YR 2/1) organic coats on faces of peds; very slight effervescence; 13 percent subrounded gravel; slightly alkaline; abrupt smooth boundary.

2C—26 to 80 inches; grayish brown (2.5Y 5/2) gravelly sand, light brownish gray (2.5Y 6/2) dry; few fine prominent yellowish brown (10YR 5/6) iron masses; single grain; loose; few discontinuous lime coats on sand and gravel; strong effervescence; 27 percent subrounded gravel; slightly alkaline.

Range in Characteristics

Mollic epipedon thickness: 16 to more than 60 inches
Depth to lime: 16 to more than 60 inches
Depth to sand and gravel: 20 to 40 inches
Notes: Some pedons have a Bk horizon that is loam or clay loam. Some pedons have a 2Bk horizon that is loamy sand, loamy fine sand, fine sandy loam, or sandy loam.

Ap horizon:
Value: 2 or 3, 3 or 4 dry
Texture: loam, clay loam, or silt loam

Bw horizon:
Chroma: 1 to 3
Texture: clay loam, loam, or sandy loam

BC horizon:
Hue: 10YR or 2.5Y
Value: 4 or 5, 5 to 7 dry
Chroma: 2 to 4

2C horizon:
Hue: 10YR or 2.5Y
Value: 4 to 6, 5 to 7 dry
Chroma: 2 to 4
Texture: sand, loamy sand; gravelly or very gravelly sand, or loamy sand

Stirum Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderately slow over rapid
Landform: Outwash plains and delta plains
Parent material: Glaciofluvial deposits
Slope: 0 to 1 percent
Notes: These soils are saline-sodic.

Taxonomic class: Coarse-loamy, mixed, superactive, frigid Typic Natraquolls

Typical pedon:
Stirum sandy loam, in an area of Stirum-Lemert sandy loams, 2,500 feet west and 300 feet south of the northeast corner of sec. 27, T. 133 N., R. 53 W.

A—0 to 3 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; slightly alkaline; abrupt irregular boundary.

Btn—3 to 8 inches; very dark gray (10YR 3/1) sandy loam, dark gray (10YR 4/1) dry; strong coarse prismatic structure parting to strong medium subangular blocky; extremely hard, firm, slightly sticky and plastic; common fine and very fine roots; few faint clay films on faces of peds; common fine irregularly shaped masses of lime; slight effervescence; strongly alkaline; clear wavy boundary.

Btkn—8 to 16 inches; dark grayish brown (2.5Y 4/2) sandy loam, grayish brown (2.5Y 5/2) dry; few medium prominent dark yellowish brown (10YR 4/4) redoximorphic concentrations; moderate medium prismatic structure parting to strong medium subangular blocky; extremely hard, firm, slightly sticky and slightly plastic; few very fine roots; tongues of the Bt horizon extend to a depth of about 15 inches; common distinct clay films on faces of peds; few fine filaments of lime; strong effervescence; very strongly alkaline; clear irregular boundary.

Bk—16 to 21 inches; light gray (10YR 7/1) sandy loam, white (10YR 8/1) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; violent effervescence; very strongly alkaline; clear wavy boundary.

C1—21 to 30 inches; dark yellowish brown (10YR 4/4) loamy sand, yellowish brown (10YR 5/4) dry; few fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; few fine irregularly shaped masses of lime; slight effervescence; very strongly alkaline; gradual wavy boundary.

C2—30 to 52 inches; dark yellowish brown (10YR 4/4) sand, yellowish brown (10YR 5/6) dry; common fine faint dark brown (10YR 3/3) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; very strongly alkaline; gradual wavy boundary.

C3—52 to 60 inches; dark grayish brown (10YR 4/2) sand, light brownish gray (10YR 6/2) dry; single grain; loose; nonsticky and nonplastic; slight effervescence; slightly alkaline.

Range in Characteristics

Depth to sandy material: 30 to more than 60 inches
Notes: Some pedons have an E horizon.

A horizon:
Hue: 10YR, 2.5Y, 5Y, or neutral
Value: 2 or 3, 3 to 5 dry
Chroma: 0 to 2

Bt horizon:
Value: 3 to 6, 4 to 8 dry
Texture: sandy loam or loam

C horizon:
Texture: loamy sand, fine sand, or sand

Svea Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow
Landform: Till plains
Parent material: Glacial till
Slope: 0 to 6 percent

Taxonomic class: Fine-loamy, mixed, superactive Pachic Udic Haploborolls

Typical pedon:
Svea loam, in an area of Barnes-Svea loams, 0 to 3 percent slopes, 1,810 feet north and 220 feet west of the southeast corner of sec. 8, T. 134 N., R. 57 W.

Ap—0 to 7 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; common fine and many very fine roots; about 1 percent gravel; neutral; abrupt smooth boundary.

A—7 to 12 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few fine and many very fine roots; about 1 percent gravel; neutral; clear wavy boundary.

Bw1—12 to 28 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, slightly sticky and

slightly plastic; few fine and common very fine roots; about 1 percent gravel; neutral; gradual wavy boundary.

Bw2—28 to 33 inches; dark grayish brown (2.5Y 4/2) loam, grayish brown (2.5Y 5/2) dry; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, slightly sticky and slightly plastic; common very fine roots; about 2 percent gravel; neutral; gradual wavy boundary.

Bk—33 to 42 inches; grayish brown (2.5Y 5/2) loam, light brownish gray (2.5Y 6/2) dry; few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; about 2 percent gravel; common medium irregularly shaped masses of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C—42 to 60 inches; light olive brown (2.5Y 5/4) loam, light yellowish brown (2.5Y 6/4) dry; common medium prominent gray (5Y 5/1) redoximorphic depletions and common medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; about 3 percent gravel; common medium irregularly shaped masses of lime; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 16 to more than 30 inches
Percent rock fragments: 1 to 10 percent
Notes: Some pedons have a BCk horizon.

A horizon:
Value: 2 or 3, 3 to 5 dry

Bw horizon:
Chroma: 1 to 4
Texture: loam or clay loam

Bk horizon:
Value: 4 to 6, 5 to 8 dry
Chroma: 2 to 4

C horizon:
Value: 4 or 5, 5 or 6 dry
Chroma: 2 to 4

Swenoda Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately rapid over moderately slow
Landform: Till plains
Parent material: Eolian deposits over glacial till
Slope: 0 to 6 percent

Taxonomic class: Coarse-loamy, mixed, superactive Pachic Udic Haploborolls

Typical pedon:
Swenoda fine sandy loam, in an area of Swenoda-Barnes complex, 0 to 6 percent slopes, 1,810 feet south and 540 feet east of the northwest corner of sec. 10, T. 133 N., R. 55 W.

Ap—0 to 8 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; common very fine roots; neutral; abrupt smooth boundary.

Bw1—8 to 21 inches; black (10YR 2/1) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and slightly plastic; common very fine roots; slightly alkaline; gradual smooth boundary.

Bw2—21 to 29 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) dry; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, nonsticky and slightly plastic; slightly alkaline; clear wavy boundary.

2Bw3—29 to 40 inches; dark grayish brown (2.5Y 4/2) clay loam, grayish brown (2.5Y 5/2) dry; weak fine prismatic structure parting to weak medium subangular blocky; hard, firm, slightly sticky and slightly plastic; about 1 percent gravel; slightly alkaline; clear wavy boundary.

2C—40 to 60 inches; grayish brown (2.5Y 5/2) clay loam, light brownish gray (2.5Y 6/2) dry; massive; hard, firm, slightly sticky and slightly plastic; about 1 percent gravel; strong effervescence; moderately alkaline.

Range in Characteristics

Depth to lime: 20 to 40 inches
Depth to glacial till: 20 to 40 inches
Notes: Some pedons have a 2Bk horizon.

A horizon:
Value: 2 or 3, 3 or 4 dry

Bw horizon:
Value: 2 to 4, 3 to 6 dry
Texture: fine sandy loam or sandy loam

2Bw horizon:
Notes: Some pedons do not have a 2Bw horizon.

2C horizon:
Hue: 10YR or 2.5Y
Value: 4 to 6, 6 to 8 dry
Chroma: 2 to 4
Texture: clay loam or loam

Tiffany Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderately rapid
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope: 0 to 1 percent

Taxonomic class: Coarse-loamy, mixed, superactive, frigid Typic Endoaquolls

Typical pedon:
Tiffany fine sandy loam, 550 feet south and 330 feet east of the northwest corner of sec. 23, T. 151 N., R. 54 W.

Ap—0 to 10 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure parting to weak fine granular; slightly hard, very friable, slightly sticky and nonplastic; common very fine roots throughout; many fine pores; slightly acid; abrupt smooth boundary.

A 10 to 15 inches; very dark gray (10YR 3/1) fine sandy loam, dark gray (10YR 4/1) dry; many fine distinct brown (10YR 4/3) redoximorphic concentrations; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots throughout; common medium pores; clear wavy boundary.

AC—15 to 23 inches; dark grayish brown (2.5Y 4/2) fine sandy loam, light brownish gray (2.5Y 6/2) dry; many medium prominent dark yellowish brown (10YR 4/4) redoximorphic concentrations; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; few very fine roots throughout; common fine pores; few fine iron-manganese concretions; clear wavy boundary.

C1—23 to 36 inches; olive brown (2.5Y 4/4) fine sandy loam, light yellowish brown (2.5Y 6/3) dry; many medium prominent strong brown (7.5YR 5/6) and few fine distinct dark gray (10YR 4/1) redoximorphic concentrations; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable, slightly sticky and nonplastic; few very fine roots throughout; common fine pores; slight effervescence (HCl, unspecified); few fine black iron-manganese concretions; clear wavy boundary.

C2—36 to 60 inches; light olive brown (2.5Y 5/4) and light brownish gray (2.5Y 6/2) stratified fine sandy loam, loamy fine sand and loamy very fine sand, pale yellow (2.5Y 7/4) and light gray (2.5Y 7/2) dry; many fine and medium prominent red (2.5YR 5/6), yellowish brown (10YR 5/6) and very dark brown (10YR 2/2) redoximorphic concentrations and olive gray (5Y 5/2) redoximorphic depletions; massive; slightly hard, very friable, nonsticky and nonplastic; slight effervescence throughout (HCl, unspecified); few fine iron-manganese concretions.

Range in Characteristics

Mollic epipedon thickness: 10 to 24 inches
Depth to lime: 20 to more than 60 inches
10 to 40 inch particle-size control section: Averages fine sandy loam to silt loam
Notes: Some pedons have a Bw or Bk horizon. Some pedons have loamy, silty or clayey materials below a depth of 40 inches.

A horizon:
Texture: fine sandy loam, sandy loam, loam, very fine sandy loam, or silt loam

AC horizon:
Notes: The horizon has redoximorphic features and they increase in number and distinctness with depth.

Tonka Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Slow

Landform: Till plains
Parent material: Alluvium over glacial till
Slope: 0 to 1 percent

Taxonomic class: Fine, smectitic, frigid Argiaquic Argialbolls

Typical pedon:
Tonka silt loam, in an area of Hamerly-Tonka-Parnell complex, 0 to 3 percent slopes, 2,500 feet west and 590 feet south of the northeast corner of sec. 2, T. 136 N., R. 56 W.

A—0 to 13 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate fine granular structure parting to moderate thin platy; soft, friable, slightly sticky and slightly plastic; many fine roots; many fine pores; slightly acid; abrupt wavy boundary.

E—13 to 19 inches; dark gray (10YR 4/1) loam, light gray (10YR 7/1) dry; many medium distinct dark brown (10YR 3/3) and dark yellowish brown (10YR 3/4) redoximorphic concentrations; moderate thin platy and moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; medium acid; abrupt irregular boundary.

Bt1—19 to 24 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; common fine distinct brown (10YR 4/3) redoximorphic concentrations; strong coarse prismatic structure parting to moderate very fine angular blocky; very hard, firm, sticky and slightly plastic; common fine roots; common distinct clay films on faces of peds; bleached sand grains coat tops of prisms and faces of peds; medium acid; gradual wavy boundary.

Bt2—24 to 34 inches; dark grayish brown (10YR 4/2) silty clay loam, light brownish gray (10YR 6/2) dry; moderate coarse prismatic structure parting to moderate very fine angular blocky; very hard, firm, sticky and slightly plastic; common fine roots; few distinct clay films on faces of peds; bleached sand grains coat faces of peds; medium acid; gradual wavy boundary.

2BC—34 to 50 inches; dark grayish brown (2.5Y 4/2) clay loam, light brownish gray (2.5Y 6/2) dry; common medium prominent dark yellowish brown (10YR 3/4) redoximorphic concentrations; weak coarse prismatic structure parting to moderate fine subangular blocky; very hard, firm, sticky and slightly plastic; few fine roots; common fine very dark brown (10YR 2/2) manganese concretions; about 2 percent gravel; neutral; gradual wavy boundary.

2Cg—50 to 60 inches; gray (5Y 5/1) clay loam, light gray (5Y 6/1) dry; many medium prominent dark brown (7.5YR 4/4) redoximorphic concentrations; weak fine platy and moderate very fine angular blocky structure; hard, friable, sticky and slightly plastic; few fine roots; common fine very dark brown (10YR 2/2) manganese concretions; about 3 percent gravel; strong effervescence; slightly alkaline.

Range in Characteristics

Depth to lime: 28 to more than 60 inches
Depth to glacial till: 30 to more than 60 inches

A horizon:
Hue: 10YR or neutral
Value: 2 or 3
Chroma: 0 or 1

E horizon:
Hue: 10YR, 2.5Y, or neutral
Value: 3 to 5, 5 to 7 dry
Chroma: 0 to 2
Texture: loam or silt loam

Bt horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 2 to 4
Texture: clay loam, silty clay loam, or silty clay

2BC horizon:
Texture: clay loam, loam, or silty clay loam

2Cg horizon:
Texture: clay loam, loam, or silty clay loam

Totten Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderately slow over rapid
Landform: Outwash plains
Parent material: Alluvium over glaciofluvial deposits
Slope: 0 to 1 percent
Notes: These soils are saline-sodic.

Taxonomic class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Typic Natraquolls

Typical pedon:
Totten loam, 2,550 feet east and 180 feet south northwest corner of sec. 7, T. 149 N., R. 65 W.

Ap—0 to 5 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate fine angular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky, slightly plastic; many fine roots and pores; a few fine pebbles; strong effervescence; moderately alkaline; abrupt smooth boundary.

Btn1—5 to 10 inches; very dark gray (10YR 3/1) sandy clay loam, dark gray (10YR 4/1) dry; interior of prisms are light brownish gray (2.5Y 6/2) and white (N 8/0) dry; moderate very coarse prismatic structure parting to strong fine and very fine angular blocky; hard, friable, sticky and plastic; common roots; clean sand grains coat faces of prisms; violent effervescence ped interiors; strong effervescence ped exteriors; moderately alkaline; clear irregular boundary.

Btn2—10 to 17 inches; light olive brown (2.5Y 5/4) sandy clay loam, light gray (2.5Y 7/2) dry; many fine and medium distinct gray and yellowish brown (5Y 6/1) redoximorphic depletions and (10YR 5/6) redoximorphic concentrations; very dark gray (10YR 3/1) coatings on faces of prisms; moderate very coarse prismatic structure parting to moderate fine and very fine angular blocky; hard, friable, slightly sticky, slightly plastic; few roots; common fine pores; diffuse limes in interior of peds; violent effervescence; moderately alkaline; gradual wavy boundary.

Bk—17 to 26 inches; olive gray (5Y 5/2) loam, light gray (5Y 7/1) dry; patches of dark grayish brown (2.5Y 4/2) on faces of prisms; many fine and medium prominent yellowish brown (10YR 5/6) and few fine prominent black (10YR 2/1) redoximorphic concentrations and medium distinct gray (5Y 6/1) redoximorphic depletions; moderate very coarse prismatic structure parting to moderate coarse and medium platy and moderate and strong fine and very fine angular blocky; hard, friable, slightly sticky, slightly plastic; few roots; slight effervescence, strong effervescence in interiors of peds; moderately alkaline; clear irregular boundary.

2C1—26 to 34 inches; light olive brown (2.5Y 5/4) coarse sand, light yellowish brown (2.5Y 6/4) dry; common distinct light gray (5Y 7/2) dry redoximorphic depletions and few fine prominent black (10YR 2/1) redoximorphic concentrations; single grain; slightly hard, loose, nonsticky; slight effervescence; moderately alkaline; clear wavy boundary.

2C2—34 to 40 inches; dark yellowish brown (10YR 4/4) gravelly coarse sand, light yellowish brown (10YR 6/4) dry; single grain; loose; 25 percent rock fragments; slight effervescence; moderately alkaline; clear wavy boundary.

2C3—40 to 60 inches; olive brown (2.5Y 4/4) and brown (10YR 5/3) stratified coarse sand and very gravelly coarse sand, light olive brown (2.5Y 5/4) and light yellowish brown (10YR 6/4) dry; single grain; loose; 10 to over 60 percent rock fragments; strong effervescence; moderately alkaline.

Range in Characteristics

Depth to sand and gravel: 14 to 40 inches

Ap horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 2 or 3, 3 or 4 dry
Texture: loam or sandy loam

Btn horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 3 to 6, 4 to 8 dry
Texture: sandy clay loam, loam, or clay loam

Bk horizon:
Hue: 5Y or 2.5Y
Value: 3 to 6, 4 to 7 dry
Chroma: 1 to 3
Texture: loam, clay loam, or sandy loam

2C horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6, 5 to 8 dry
Chroma: 1 to 4
Texture: sand or coarse sand
Notes: It averages 10 to 40 percent gravel.

Towner Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Rapid over moderately slow
Landform: Delta plains
Parent material: Eolian deposits over glacial till
Slope: 0 to 3 percent

Taxonomic class: Sandy over loamy, mixed, superactive Udorthentic Haploborolls

Typical pedon:
Towner loamy fine sand, 0 to 3 percent slopes, 2,420 feet east and 1,750 feet south of the northwest corner of sec. 15, T. 133 N., R. 54 W.

Ap—0 to 7 inches; black (10YR 2/1) loamy fine sand, very dark gray (10YR 3/1) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine roots; neutral; abrupt smooth boundary.

A—7 to 20 inches; black (10YR 2/1) loamy fine sand, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine roots; neutral; clear wavy boundary.

Bw—20 to 29 inches; dark grayish brown (10YR 4/2) loamy fine sand, grayish brown (10YR 5/2) dry; many fine distinct dark yellowish brown (10YR 4/4) redoximorphic concentrations; weak fine subangular blocky structure; soft, very friable; nonsticky and nonplastic; common fine roots; slightly alkaline; abrupt wavy boundary.

2Bk—29 to 37 inches; grayish brown (2.5Y 5/2) silty clay loam, light gray (2.5Y 7/2) dry; many fine distinct light olive brown (2.5Y 5/6) redoximorphic concentrations; weak medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; about 2 percent gravel; strong effervescence; moderately alkaline; gradual wavy boundary.

2C—37 to 60 inches; grayish brown (2.5Y 5/2) clay loam, light gray (2.5Y 7/2) dry; many medium prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; massive; hard, friable, sticky and slightly plastic; about 3 percent gravel; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 16 to 30 inches
Depth to glacial till: 20 to 40 inches

A horizon:
Value: 2 or 3, 3 or 4 dry

Bw horizon:
Hue: 10YR or 2.5Y
Value: 3 to 5, 4 to 6 dry
Chroma: 1 to 4
Texture: loamy sand, loamy fine sand, or fine sand

2C horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6, 6 to 8 dry
Chroma: 2 to 4
Texture: loam or clay loam

Ulen Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Rapid
Landform: Delta plains
Parent material: Glaciofluvial deposits
Slope: 0 to 1 percent
Notes: These soils are highly calcareous.

Taxonomic class: Sandy, mixed, frigid Aeric Calciaquolls

Typical pedon:
Ulen fine sandy loam, 2,100 feet south and 50 feet east of the northwest corner of sec. 29, T. 136 N., R. 53 W.

Ap—0 to 9 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky and nonplastic; common very fine roots; slight effervescence; slightly alkaline; abrupt smooth boundary.

Ak—9 to 14 inches; very dark gray (10YR 3/1) fine sandy loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; soft, very friable; slightly sticky and nonplastic; common very fine roots; strong effervescence; slightly alkaline; clear wavy boundary.

Bk1—14 to 19 inches; dark gray (10YR 4/1) loamy fine sand, gray (10YR 5/1) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

Bk2—19 to 30 inches; light olive brown (2.5Y 5/4) fine sand, light gray (2.5Y 7/2) dry; single grain; loose; nonsticky and nonplastic; strong effervescence; moderately alkaline; gradual wavy boundary.

C1—30 to 42 inches; light olive brown (2.5Y 5/4) fine sand, light yellowish brown (2.5Y 6/4) dry; common medium distinct light olive brown (2.5Y 5/6) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; slight effervescence; slightly alkaline; gradual wavy boundary.

C2—42 to 60 inches; light olive brown (2.5Y 5/4) fine sand, light yellowish brown (2.5Y 6/4) dry; many medium distinct dark yellowish brown (10YR 4/4) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; slight effervescence; slightly alkaline.

Range in Characteristics

Mollic epipedon thickness: 10 to 20 inches

A horizon:
Chroma: 1 or 2

C horizon:
Hue: 10YR, 2.5Y, or 5Y
Value: 4 to 6
Chroma: 2 to 6
Texture: fine sand, loamy fine sand, or sand
Notes: It has loamy or silty strata below a depth of 40 inches in some pedons.

Vallers Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderately slow
Landform: Till plains
Parent material: Glacial till
Slope: 0 to 1 percent
Notes: These soils are highly calcareous.

Taxonomic class: Fine-loamy, mixed, superactive, frigid Typic Calciaquolls

Typical pedon:
Vallers loam, in an area of Vallers-Parnell complex, 200 feet south and 1,350 feet west of the northeast corner of sec. 32, T. 136 N., R. 56 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; about 1 percent gravel; slight effervescence; slightly alkaline; abrupt smooth boundary.

ABk—8 to 12 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; about 1 percent gravel; common filaments and irregularly shaped masses of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

Bkg1—12 to 19 inches; light olive gray (5Y 6/2) loam, white (5Y 8/1) dry; common fine distinct olive yellow (5Y 6/6) redoximorphic concentrations; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, sticky and plastic; common fine roots; about 2 percent gravel; violent effervescence; moderately alkaline; gradual wavy boundary.

Bkg2—19 to 26 inches; light olive gray (5Y 6/2) loam, white (5Y 8/1) dry; common fine distinct olive yellow (5Y 6/6) and few fine prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; weak coarse prismatic structure; hard, friable, sticky and plastic; common very fine roots; about 2 percent gravel; common medium irregularly shaped masses of lime; violent effervescence; moderately alkaline; gradual wavy boundary.

Bkg3—26 to 31 inches; olive gray (5Y 5/2) loam, light gray (5Y 7/2) dry; many fine prominent light yellowish brown (2.5Y 6/4) redoximorphic concentrations; moderate medium subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; about 2 percent gravel; many medium irregularly shaped masses of lime; violent effervescence; gradual wavy boundary.

Bkg4—31 to 38 inches; olive gray (5Y 4/2) loam, light olive gray (5Y 6/2) dry; many medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; weak medium subangular blocky structure; hard, friable, sticky and plastic; about 3 percent gravel; many medium irregularly shaped masses of lime; violent effervescence; gradual wavy boundary.

Cg1—38 to 46 inches; olive gray (5Y 5/2) loam, light gray (5Y 7/2) dry; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; massive; slightly hard, firm, sticky and plastic; about 4 percent gravel; few medium manganese concretions; few fine irregularly shaped masses of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg2—46 to 60 inches; olive gray (5Y 5/2) loam, light gray (5Y 7/2) dry; many medium prominent

yellowish brown (10YR 5/6) redoximorphic concentrations; massive; slightly hard, firm, sticky and plastic; about 4 percent gravel; common medium manganese concretions; few fine irregularly shaped masses of lime; slight effervescence.

Range in Characteristics

Mollic epipedon thickness: 7 to 25 inches
Salinity: The soil is saline in some pedons.

A horizon:
Hue: 10YR, 2.5Y, 5Y, or neutral
Chroma: 0 or 1

Bkg horizon:
Hue: 10YR, 2.5Y, 5Y, or neutral
Value: 3 to 6
Chroma: 0 to 2
Texture: loam or clay loam
Notes: It has few to common nests of gypsum in some pedons.

Cg horizon:
Hue: 2.5Y or 5Y
Value: 4 to 7
Chroma: 1 to 3
Texture: loam or clay loam

Vang Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate over very rapid
Landform: Outwash plains
Parent material: Glaciofluvial deposits
Slope: 1 to 3 percent
Taxonomic class: Fine-loamy over sandy or sandy-skeletal, mixed, superactive Pachic Udic Haploborolls

Typical pedon:
Vang loam, in an area of Brantford-Vang loams, 1 to 3 percent slopes, 1,860 feet west and 520 feet south of the northeast corner of sec. 20, T. 135 N., R. 58 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure parting to weak fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; neutral; abrupt smooth boundary.

Bw1—9 to 17 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; neutral; clear wavy boundary.

Bw2—17 to 21 inches; very dark grayish brown (2.5Y 3/2) loam, dark grayish brown (2.5Y 4/2) dry; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; neutral; clear wavy boundary.

Bw3—21 to 27 inches; dark grayish brown (2.5Y 4/2) loam, grayish brown (2.5Y 5/2) dry; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; about 5 percent gravel; neutral; gradual wavy boundary.

2C1—27 to 32 inches; dark grayish brown (2.5Y 4/2) very gravelly loamy sand, light brownish gray (2.5Y 6/2) dry; few fine distinct light olive brown (2.5Y 5/4) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; about 45 percent shale gravel; slightly alkaline; gradual wavy boundary.

2C2—32 to 60 inches; grayish brown (2.5Y 5/2) gravelly sand, light brownish gray (2.5Y 6/2) dry; few fine distinct olive yellow (2.5Y 6/6) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; about 30 percent shale gravel; slight effervescence; slightly alkaline.

Range in Characteristics

Mollic epipedon thickness: 16 to 33 inches
Depth to sand and gravel: 20 to 40 inches

A horizon:
Value: 2 or 3, 3 or 4 dry

Bw horizon:
Value: 4 to 6 dry
Chroma: 1 to 3
Texture: loam or clay loam
Notes: It has up to 10 percent gravel.

2C horizon:
Hue: 2.5Y or 5Y
Value: 2 to 6, 5 to 7 dry
Chroma: 1 to 5

Venlo Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Rapid
Landform: Delta plains
Parent material: Eolian deposits
Slope: 0 to 1 percent

Taxonomic class: Sandy, mixed, frigid Typic Endoaquolls

Typical pedon:
Venlo fine sandy loam, 1,000 feet north and 130 feet east of the southwest corner of sec. 1, T. 134 N., R. 54 W.

A—0 to 13 inches; black (N 2/0) fine sandy loam, very dark gray (N 3/0) dry; weak medium subangular blocky structure parting to weak very fine granular; soft, very friable, nonsticky and nonplastic; few fine and very fine roots; neutral; clear smooth boundary.

Cg1—13 to 30 inches; olive gray (5Y 5/2) fine sand, light gray (5Y 7/2) dry; common distinct greenish gray (5GY 5/1) redoximorphic depletions; single grain; loose; nonsticky and nonplastic; few very fine roots; slightly alkaline; gradual wavy boundary.

Cg2—30 to 60 inches; gray (5Y 5/1) fine sand, light gray (5Y 7/1) and white (5Y 8/1) dry; single grain; loose; nonsticky and nonplastic; slight effervescence; slightly alkaline.

Range in Characteristics

Mollic epipedon thickness: 10 to 24 inches
Notes: Some pedons have an O horizon up to 6 inches thick. Some pedons have an Ab horizon.

A horizon:
Hue: 10YR, 2.5Y, 5Y, or neutral
Value: 2 or 3, 3 to 5 dry
Chroma: 0 to 1

Cg horizon:
Hue: 2.5Y, 5Y, 5GY, or neutral
Value: 4 to 6, 5 to 8 dry
Chroma: 0 to 2
Texture: loamy sand, loamy fine sand, fine sand, or sand

Wahpeton Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow
Landform: Flood plains
Parent material: Alluvium
Slope: 0 to 1 percent

Taxonomic class: Fine, smectitic, frigid Typic Haploborolls

Typical pedon:
Wahpeton silty clay, 2,560 feet south and 420 feet west of the northeast corner of sec. 9, T. 135 N., R. 53 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to moderate medium granular; very hard, friable, very sticky and plastic; many very fine roots; slightly alkaline; abrupt smooth boundary.

A—7 to 19 inches; black (10YR 2/1) silty clay, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure parting to strong fine subangular blocky; very hard, very firm, sticky and plastic; common very fine roots; cracks 2 to 3 cm wide extend throughout; slightly alkaline; clear wavy boundary.

C1—19 to 33 inches; dark grayish brown (2.5Y 4/2) silty clay loam, light brownish gray (2.5Y 6/2) dry; few fine faint olive brown (2.5Y 4/3) redoximorphic concentrations; moderate medium subangular blocky structure parting to strong fine subangular blocky; very hard, very firm, sticky and plastic; cracks filled with dark colored A material extend throughout; strong effervescence; moderately alkaline; clear wavy boundary.

C2—33 to 39 inches; very dark gray (5Y 3/1) silty clay, gray (5Y 5/1) dry; few fine prominent light olive brown (2.5Y 5/6) redoximorphic concentrations; moderate medium subangular blocky structure parting to strong fine angular blocky; very hard, very firm, very sticky and very plastic; strong effervescence; moderately alkaline; clear wavy boundary.

C3—39 to 52 inches; dark gray (5Y 4/1) silty clay, light gray (5Y 6/1) dry; common fine prominent

dark yellowish brown (10YR 4/4) redoximorphic concentrations; massive; extremely hard, extremely firm; very sticky and very plastic; common fine and few medium masses of lime; strong effervescence; slightly alkaline; gradual wavy boundary.

C4—52 to 60 inches; dark gray (10YR 4/1) silty clay, light gray (5Y 6/1) dry; many fine distinct dark yellowish brown (10YR 4/4) redoximorphic concentrations; extremely hard, extremely firm; very sticky and very plastic; few medium and many fine masses of lime; strong effervescence; slightly alkaline.

Range in Characteristics

Mollic epipedon thickness: 16 to 40 inches
Notes: Some pedons have cracks that extend from the surface to a depth of 60 inches or more when dry. Some pedons have an Ab horizon.

A horizon:
Value: 2 or 3, 3 to 5 dry

C horizon:
Value: 3 to 5, 4 to 6 dry
Texture: clay, silty clay, or silty clay loam

Wyndmere Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderately rapid
Landform: Delta plains
Parent material: Glaciofluvial deposits
Slope: 0 to 1 percent
Notes: These soils are highly calcareous.

Taxonomic class: Coarse-loamy, mixed, superactive, frigid Aeric Calciaquolls

Typical pedon:
Wyndmere loam, 2,470 feet west and 550 feet south of the northeast corner of sec. 22, T. 133 N., R. 53 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular; slightly hard, very friable, slightly sticky and nonplastic; many very fine roots; slight effervescence; slightly alkaline; abrupt smooth boundary.

ABk—9 to 14 inches; dark grayish brown (10YR 4/2) fine sandy loam, gray (10YR 5/1) dry; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; common very fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

Bk—14 to 27 inches; grayish brown (10YR 5/2) fine sandy loam, light gray (10YR 7/1) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; violent effervescence; moderately alkaline; gradual wavy boundary.

C1—27 to 34 inches; light olive brown (2.5Y 5/4) fine sand, light yellowish brown (2.5Y 6/4) dry; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; few fine roots; slight effervescence; moderately alkaline; clear wavy boundary.

C2—34 to 60 inches; light olive brown (2.5Y 5/4) fine sand, light yellowish brown (2.5Y 6/4) dry; common medium distinct dark yellowish brown (10YR 4/4) redoximorphic concentrations; single grain; loose; nonsticky and nonplastic; slight effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 16 inches

A horizon:
Value: 2 or 3, 3 to 5 dry

ABk horizon:
Notes: Some pedons do not have an ABk horizon.

Bk horizon:
Hue: 2.5Y or 10YR
Value: 3 to 5, 4 to 7 dry

C horizon:
Hue: 10YR or 2.5Y
Value: 4 to 7, 5 to 8 dry
Chroma: 2 to 4

Zell Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate

Landform: Lake plains and terraces
Parent material: Glaciolacustrine deposits
Slope: 3 to 25 percent
Notes: These soils are highly calcareous.

Taxonomic class: Coarse-silty, mixed, superactive Udic Calciborolls

Typical pedon:
Zell loam, 9 to 25 percent slopes, 2,050 feet east and 1,600 feet south of the northwest corner of sec. 17, T. 135 N., R. 54 W.

Ap—0 to 7 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure parting to moderate medium granular; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; slight effervescence; slightly alkaline; abrupt smooth boundary.

Bk1—7 to 17 inches; dark brown (10YR 4/3) silt loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; many very fine and common fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

Bk2—17 to 29 inches; light olive brown (2.5Y 5/4) silt loam, light yellowish brown (2.5Y 6/4) dry; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; violent effervescence; moderately alkaline; clear smooth boundary.

C—29 to 60 inches; olive brown (2.5Y 4/4) silt loam, light yellowish brown (2.5Y 6/4) dry; massive; soft, very friable, slightly sticky and slightly plastic; few very fine roots to 43 inches; strong effervescence; moderately alkaline.

Range in Characteristics

Mollic epipedon thickness: 7 to 10 inches

A horizon:
Value: 2 or 3, 3 or 4 dry

Bk horizon:
Value: 3 to 6, 5 to 8 dry
Texture: silt loam or very fine sandy loam

C horizon:
Hue: 10YR or 2.5Y
Value: 4 to 6, 6 to 8 dry
Chroma: 2 to 4

Agronomy

About 72 percent of Ransom County is cultivated. In1996, acreage planted to the principal close-grown crops were as follows: spring wheat, 130,000 acres; durum wheat, 1,300 acres; winter wheat, 2,000 acres; barley, 20,000 acres; and oats, 2,700 acres. The main row crops were sunflowers, dry beans, soybeans and corn. Sunflowers were planted on 34,000 acres; dry edible beans were planted on 15,000 acres; soybeans were planted on 21,000 acres; and corn on 76,000 acres. Alfalfa and other hay crops were planted on 26,000 acres. Small acreages were planted to canola, buckwheat, mustard, lentils, millet, safflower, soybeans, and dry edible beans (Beard and Waldhaus, 1997).

Cropland limitations and general management practices needed for crops and hay and pasture are discussed in this section. Soil interpretive groups used by the Natural Resources Conservation Service for important farmlands, soil productivity indexes, land capability, pasture and hay, and windbreaks are explained. Soil quality and the management of saline and sodic soils are also discussed.

Planners of management systems for individual fields or farms should consider obtaining specific information from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Cropland Limitations and Management

Management concerns affecting the use of detailed map units in the survey area for crops are shown in Table 6, "Potential Cropland Limitations and Hazards." The primary concerns in managing cropland are conserving moisture, controlling wind and water erosion, and maintaining or improving soil fertility and tilth.

Moisture at planting time is critical to the success of the crop during the growing season. In years where the amount of available soil moisture is low at planting time, crop success for the year is greatly reduced. Measures that reduce evaporation and runoff rates, increase the rate of water infiltration, and control weeds conserve moisture.

Applying conservation tillage and conservation cropping systems, farming on the contour, stripcropping, establishing field windbreaks, trapping snow, and leaving crop residue on the surface also conserve moisture. When fallow is used to carry moisture over to the next season, a cover of crop residue is essential during winter to guard against moisture loss and erosion.

Wind erosion may be a hazard on most of the soils in Ransom County. It is severe on the coarse textured and moderately coarse textured soils, such as Arvilla, Falsen, Hamar, Hecla, Lemert, Letcher, Maddock, Rosewood, Serden, Sioux, Stirum, Swenoda, Ulen, and Venlo. It is also a severe hazard on Bearden, Buse, Colvin, Divide, Fairdale, Glyndon, Hamerly, Hegne, Lamoure, Marysland, Rauville, Vallers, Wyndmere, and Zell soils. These soils have a relatively high content of lime and are susceptible to wind erosion in the spring if they have been bare throughout the winter. Because of freezing and thawing, soil structure can break down, resulting in aggregates that are susceptible to movement. This can cause fine textured soils, such as Hegne, Ryan, and Wahpeton, to have a severe wind erosion hazard. Nearly all soils can be damaged by wind erosion if they are not protected by residue.

Water erosion is a severe hazard on gently rolling and steeper soils, such as Barnes, Buse, and Zell. The hazard is greatest when the surface is bare.

Conservation practices that control both wind and water erosion are those that maintain a protective cover on the surface. Examples are conservation tillage systems that keep a protective amount of crop residue on the surface. Applications of approved herbicides can help to eliminate the need for summer fallow tillage. Cover crops are also effective in controlling both wind and water erosion. Field windbreaks, annual vegetative barriers, and stripcropping help to control wind erosion (fig. 10). Inclusion of grasses and legumes in the cropping sequence, grassed waterways, diversions, terraces,

Figure 10. Field windbreaks and conservation tillage help prevent wind erosion.

contour farming, and field stripcropping across the slope help to control water erosion. A management system that includes several measures is the best means of protecting the soil. For example, conservation tillage can control soil blowing during years when the amount of crop residue is adequate, but windbreaks are needed during years when the amount of residue is low.

Measures effective in maintaining or improving soil fertility and tilth include utilizing a nutrient management system that includes applying fertilizer, both organic and inorganic, including manure; incorporating crop residue or green manure crops into the soil; and using proper crop rotations. Wind and water erosion reduce productivity of soils. If the surface layer is lost, most of the available plant nutrients also are lost. As a result, applications of fertilizer are needed to maintain adequate crop production.

Of equal concern is the loss of organic matter through erosion. Soil structure, water infiltration, available water capacity, and tilth are all negatively affected by this loss. As organic matter is lost and the subsoil is exposed and tilled, the remaining soil becomes increasingly susceptible to both wind and water erosion. Controlling erosion helps prevent loss of organic matter and plant nutrients and helps maintain productivity. The level of fertility may be reduced even in areas where erosion is controlled. All soils used for crops generally respond well to a nutrient management system. Proper management of soils includes measures that maintain good tilth. These measures are especially needed on the Cavour, Exline, Larson, Lemert, Letcher, Ryan, Stirum, and Totten soils that have a sodic subsoil and on the Ryan and Wahpeton soils that have a silty clay surface layer. Measures that maintain the content of organic matter are very important if good tilth is to be maintained. The traditional practice of clean-tilled summer fallow contributes to the loss of organic matter partly because it increases the susceptibility to erosion.

Additional limitations and management practices are as follows:

Alkalinity. This limitation reduces availability of selected nutrients and is associated with restricted seedling emergence and water infiltration. This limitation can be reduced with a nutrient management system and timely tillage operations. Tilling when the soil is neither too wet nor too dry helps to maintain tilth and prevent surface compaction. Maintaining crop residue on the surface and adding organic material to the plow layer help increase organic matter, prevent surface crusting, and maintain or improve tilth and fertility.

This limitation exists if the soil's pH is more that 7.8 at the surface.

Areas of rock outcrop. These areas are usually not accessible for cultivation and generally are unsuited to cultivated crops and hay and pasture. Farming around these areas may reduce the impact of this limitation on farming operations.

This limitation exists if "rock outcrop" is included in the name of the map unit.

Channels. These areas consist of meandering streams and oxbows. Most areas are isolated by streams or are irregularly shaped and often have standing water in the spring. These areas generally are unsuited to cultivated crops.

This limitation exists if "channeled" is included in the name of the map unit.

Dense layer. This limitation slows water infiltration and restricts root penetration. It can be managed by using a cropping system that includes deep-rooted legumes, such as alfalfa and sweetclover, and deep tillage to improve root and water penetration. Incorporating organic material into the soil also helps to improve root and water penetration.

This limitation exists if the bulk density is greater than 1.7 in any soil layer.

Depth to rock. This limitation restricts rooting depth. It can be managed by planting shallow-rooted, moisture-efficient crops adapted to the area. A moisture conservation program may be effective on these areas. Some areas that are less than 20 inches to bedrock are not suitable for cultivated crops.

This limitation exists if soft or hard bedrock is within a depth of 40 inches.

Depth to sand and gravel. This limitation restricts rooting depth and may increase the potential for pesticide and nutrient leaching. It can be managed by planting shallow-rooted, moisture-efficient crops adapted to the area. A moisture conservation program may be effective in these areas. Some areas less than 12 inches to sand and gravel are not suitable for cultivated crops.

This limitation exists if there is more than 35 percent gravel in any soil layer at a depth of less than 40 inches.

Excessive saturated hydraulic conductivity. This limitation may cause deep leaching of nutrients and pesticides. A nutrient and pesticide management system with a moisture conservation program, which includes following pesticide labels and fertilizing based on soil nutrient tests, can help manage these areas. Some areas may be unsuitable for cultivated crops.

This limitation exists if the saturated hydraulic conductivity of any soil layer is 6 inches per hour or more.

Flooding. This limitation can affect the timely seeding and survival of crops. In some situations this limitation can be managed by protecting the soil from flooding by diking or by building water retention structures and by planting vegetation that is adapted to flooded conditions. Some areas may be unsuitable for cultivated crops or protection measures may not be economical.

This limitation exists if the map unit is either occasionally flooded for long or very long periods or frequently flooded.

Gullies. This limitation makes cultivation difficult and hazardous. Generally, gullies are so deep that extensive reshaping is necessary for most uses. They generally are unsuited to cultivated crops, hay, and pasture.

This limitation exists if "gullied" is included in the name of the map unit.

High sodium content. This limitation restricts root, air, and water penetration in the subsoil. It may cause poor tilth and compaction. Tillage at the proper moisture content helps to maintain tilth. Tillage that loosens the dense, sodic subsoil or growing deep-rooted legumes, such as alfalfa and sweetclover, may improve soil physical conditions. For additional information about managing these soils see "Management of Saline and Sodic Soils."

This limitation exists if the sodium adsorption ratio (SAR) is more than 15 within a depth of 30 inches or if the soil is classified as an Aridic, Borollic, Leptic, Typic, Udic, or Vertic Natriboroll.

High water table. Wetness in undrained areas can delay tillage, seeding, and harvest operations in most years and prevent them in some years. Drained areas are suited to cultivated crops but locating suitable drainage outlets generally is difficult. Planting crops that are tolerant to wetness minimizes the impact of the high water table.

This limitation exists if the water table is within a depth of 36 inches.

Lime content. High lime content at the surface may cause increased wind erosion and surface crusting. It may also reduce availability of selected nutrients. This limitation can be managed by a system of conservation tillage that leaves crop residue on the surface, field windbreaks, stripcropping, and annual buffer strips to help control wind erosion. Field windbreaks planted on slopes greater than 8 percent may contribute to water erosion by concentrating spring runoff. Crops may respond well to a nutrient

management system that includes additions of phosphate fertilizer.

This limitation exists if the soil is assigned to wind erodibility group 4L or has more than 5 percent $CaCO_3$ in the upper 10 inches.

Limited available water capacity. This limitation reduces the capacity of the soil to retain moisture for plant use. A moisture conservation program can help manage these areas.

This limitation exists if the available water capacity calculated to a depth of 60 inches or to a root-limiting layer is 8.5 inches or less or the electrical conductivity (EC) is more than 8 at less than 30 inches and the soil is moderately well drained or better.

Limited organic matter. This limitation may cause an increase in surface crusting and reduce the soil's natural fertility. Soil organic matter can be managed by utilizing a nutrient management system, incorporating crop residue or green manure crops into the soil, and using proper crop rotations.

This limitation exists if the content of organic matter is 1 percent or less in the surface layer.

Pesticide and nutrient leaching. This limitation increases the hazard of contaminating aquifers, springs, and local water tables. A nutrient and pesticide management system with a moisture conservation program, which includes following pesticide labels and fertilizing based on soil nutrient tests, can help manage these areas. Some areas may be unsuitable for cultivated crops.

This limitation exists if the depth to the water table is 48 inches or less, depth to bedrock is less than 60 inches, or saturated hydraulic conductivity of any soil layer is 6 inches per hour or more.

Pesticide and nutrient runoff. This limitation increases the hazard of contaminating surface waters, such as lakes, ponds, steams, and rivers. It can be managed with nutrient, pesticide, and conservation tillage systems which include leaving crop residue on the surface, following pesticide labels, and fertilizing based on soil nutrient testing. Limiting row crops on slopes of more than 8 percent reduces the rate of runoff of pesticides and nutrients. Runoff from upland areas can concentrate pesticides on ponded soils. Draining ponded areas may adversely affect the receiving surface waters.

This limitation exists if the soil is occasionally flooded or frequently flooded; is subject to ponding; is assigned to hydrologic group C or D and has a slope of more than 2 percent; is assigned to hydrologic group A and has a slope of more than 6 percent; or is assigned to hydrologic group B, has a slope of 3 percent or more, and has a K factor of more than 0.17.

Ponding. This limitation can affect the timely seeding, harvesting, and survival of crops. Because of wetness and ponding, this soil generally is unsuited to cultivated crops, hay and pasture, and range.

This limitation exists if ponding occurs on the soil.

Poor tilth and compaction. This limitation restricts seedling emergence and water infiltration. It can be managed by timely tillage operations, maintaining crop residue on the surface, and adding organic material to the plow layer to increase soil organic matter. A cropping system that includes deep-rooted legumes, such as alfalfa and sweetclover, may improve root and water penetration.

This limitation exists if the upper 10 inches of the soil has more than 35 percent clay; has less than 1 percent organic matter; or has SAR of 5 or more.

Restricted saturated hydraulic conductivity. This limitation restricts root penetration and water saturated hydraulic conductivity. It can be managed with timely tillage operations and by using a cropping system that includes deep-rooted legumes, such as alfalfa and sweetclover, to improve root and water penetration. Incorporating organic material into the soil also helps to improve root and water penetration.

This limitation exists if saturated hydraulic conductivity is 0.06 inch per hour or less within a depth of 40 inches.

Root limiting. This limitation reduces the effectiveness of roots when the soil dries and increases moisture stress during extended dry periods. It can be managed with a cropping system that includes deep-rooted legumes, such as alfalfa and sweetclover, and deep tillage to improve root and water penetration in the subsoil. Tillage when the soil is neither too wet nor too dry helps to maintain tilth. A moisture conservation system may be beneficial. For additional information about managing these soils see "Management of Saline and Sodic Soils."

This limitation exists if the soil is classified as a Glossic or Glossic Udic Natriboroll.

Salt content. This limitation interferes with plant growth by restricting nutrient uptake and reducing available water. Using nutrient management and moisture conservation systems and growing salt-tolerant crops, such as barley, can help manage these areas. For additional information about managing these soils see "Management of Saline and Sodic Soils."

This limitation exists if the soil has an EC of more than 4 in the surface layer or more than 8 within a depth of 30 inches.

Slick spots. The surface of these areas is non-vegetated and tends to puddle upon wetting. Slick

spots are restrictive to air, water, and root growth. These areas are best suited to range. Because of the dense and massive layers, they generally are unsuited to cultivated crops, hay, and pasture. For additional information about managing these soils see "Management of Saline and Sodic Soils."

This limitation exists if "Slick spot" is included in the name of the map unit.

Slope. This limitation increases the potential for accelerated water erosion unless conservation farming practices are applied.

This limitation exists if the upper slope range of the map unit is more than 8 percent.

Soil slumping. This limitation indicates a potential for mass soil movement. These areas generally are unsuited to cultivated crops, hay, and pasture.

This limitation exists if the slope is more than 35 percent and the surface or subsoil has more than 35 percent clay; or if the slope is more than 25 percent and the subsoil contains more than 35 percent clay and bedrock is at a depth of less than 60 inches; or if "slumped" is a modifier of any named component of the map unit.

Surface crusting. This limitation restricts seedling emergence and water infiltration. It can be managed with a system of conservation tillage that leaves crop residue on the surface and by incorporating organic material into the surface layer.

This limitation exists if the surface texture is silt, silt loam, silty clay loam, or very fine sandy loam and the surface layer organic matter content is less than 3 percent; or if the surface texture is loamy very fine sand, very fine sandy loam, fine sandy loam, sandy loam, sandy clay loam, loam, clay loam, silt, silt loam, or silty clay loam and the surface layer Calcium Carbonate Equivalent ($CaCO_3$) is equal to or greater than 1; or if the surface layer or upper 10 inches has a SAR of 4 or more.

Surface rock fragments. This limitation adversely affects the use of mechanical equipment for cultivation and causes rapid wear of tillage equipment and difficult seedbed preparation. It cannot be easily overcome. These areas are generally unsuited to cultivated crops, hay, and pasture.

This limitation exists if the texture of the surface layer includes any rock fragment modifier except for gravelly or channery and "surface stones" are not already indicated as a limitation.

Surface stones. This limitation restricts normal cultivation practices. These areas are generally unsuited to cultivated crops, hay, and pasture. Economic removal of the surface stones generally is not feasible.

This limitation exists if the surface layer texture includes stony or bouldery modifiers or if "stony" or "bouldery" are included in the map unit name.

Water erosion. This limitation indicates an increased hazard of water erosion. This limitation can be managed by a system of conservation tillage that leaves crop residue on the surface, contour stripcropping, and grassed waterways in areas where runoff concentrates.

This limitation exists if the surface K factor (soil erodibility factor) multiplied by the upper slope percent is more than 2.

Wind erosion. This limitation indicates an increased hazard of wind erosion. This limitation can be managed by using a system of conservation tillage that leaves crop residue on the surface, field windbreaks, stripcropping, annual crop barriers, and a cropping sequence that includes grass-legume hay.

This limitation exists if the wind erodibility group is 1, 2, 3, 4, or 4L.

Erosion Factors

Soil erosion factors are used with other information to estimate the amount of soil lost through water and wind erosion. The procedure for predicting soil loss is useful in guiding and comparing the selection of soil and water conservation practices. The soil erodibility factors (K and Kf), the soil-loss tolerance factor (T), wind erodibility index (I), and wind erodibility groups (WEG) are described in "Physical Properties" in the "Soil Properties" section. Additional information about soil factors affecting wind and water erosion can be obtained from local offices of the Natural Resources Conservation Service or the Cooperative Extension Service.

Prime Farmland and Other Important Farmland

In this section, prime farmland and other important farmland are defined. The map units in the survey area that are considered prime farmland, prime farmland if drained, farmland of statewide importance, or other land are listed on Table 7, "Map Unit Productivity Index and Farmland Designation." Most map units have minor areas or inclusions that do not meet the listed farmland designation. More information about the criteria for prime farmland and other important farmland can be obtained at the local office of the Natural Resources Conservation Service.

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forest land, or other land, but it is not urban, built-up land, or water areas. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce sustained high yields of crops in an economic manner.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods and it is not frequently flooded during the growing season or it is protected from flooding. The slope ranges mainly from 0 to 6 percent.

Soils with a seasonal high water table may qualify as prime farmland where this limitation is overcome by drainage measures. Onsite evaluation is necessary to determine the effectiveness of corrective measures.

A recent trend in land use in some parts of the nation has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive.

About 328,020 acres, or nearly 59 percent of the survey area, meets the requirements for prime farmland. The location of each map unit is shown on the detailed soil maps. The soil qualities that affect use and management are described in the section "Detailed Map Units" and "Soil Series and Their Morphology".

Farmland of Statewide Importance

Some areas, other than areas of prime farmland, are of statewide importance in the production of food, feed, fiber, forage, and oilseed crops. The criteria used in defining and delineating these areas are determined by appropriate state and federal agencies. Generally, farmland of statewide importance includes areas that nearly meet the criteria for prime farmland and that economically produce high yields of crops when treated and managed with acceptable farming methods. Some areas can produce as high a yield as areas of prime farmland if conditions are favorable.

Other Land

Lands not meeting the criteria for Prime Farmland or Farmland of Statewide Importance are placed into Other Land on Table 7, "Map Unit Productivity Index and Farmland Designation".

This group includes Farmland of Local Importance, Unique Farmland, and Other Land. These farmlands may have agricultural or non-agricultural uses.

Productivity Indexes and Crop Yield Estimates

Productivity indexes are relative ratings of the ability of a soil to produce a particular crop yield in comparison to other soils under a defined management system. They are useful in estimating long-term average crop yields, comparing the production capacity of soils and in various economic analyses. Productivity indexes are shown in Table 7, "Map Unit Productivity Index and Farmland Designation." The average yields per acre that can be expected of the principal crops grown in the county under a high level of management are shown in Table 8, "Yields per Acre of Crops." Productivity indexes are given for drained conditions and, where applicable, undrained conditions.

Productivity indexes are based on soil properties important to crop production. Knowledgeable and experienced soil scientists, conservationists, and university researchers developed the indexes. They used results from field trials, demonstrations, and records, and experiences of producers (Ulmer and Patterson, 1988 a, b, c). In North Dakota, productivity indexes are based on long-term average spring wheat production. Similar and contrasting map unit inclusions are considered along with the named map unit components when the productivity index is calculated. The index ranges from 0, which indicates no long-term economic production, to 100, which indicates the highest potential production. Productivity indexes are based on the best available information, but they are difficult to determine for soils with variable properties such as salinity, sodicity, and degree of drainage.

In Ransom County, a productivity index of 100 was considered equal to a long-term average yield of 48 bushels per acre of spring wheat. Multiplying the productivity index by 48 and dividing the product by 100 converts the index number to a figure representing the expected long-term average yield per acre. For

example, map unit 156 Barnes-Svea loams, 3 to 6 percent slopes, has a productivity index of 81. This number multiplied by 48 and then divided by 100 converts to 39, which is the expected long-term average yield of spring wheat in bushels per acre for this map unit. In any given year, yields may be higher or lower than those indicated in the table because of variations in management, rainfall, and other production and climatic factors. Estimated yields reflect the production capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. Productivity of a given soil compared with that of other soils, however, is not likely to change.

Management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include nutrient management systems, moisture conservation, and conservation tillage.

Crops other than those shown in the table are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. Soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. Criteria used in grouping the soils do not take into account extensive and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, woodland, or engineering purposes. The capability classification of each map unit is given in Table 9, "Interpretive Groupings Report."

In the land capability system, as described in "Land Capability Classification" (USDA-SCS, 1961), soils generally are grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. Capability classes are given for drained conditions and, where applicable, undrained conditions.

Capability classes, the broadest groups, are designated by numerals 1 through 8. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have few limitations that restrict their use.

Class 2 soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.

Class 3 soils have severe limitations that reduce the choice of plants or require special conservation practices, or both.

Class 4 soils have very severe limitations that reduce the choice of plants and require very careful management, or both.

Class 5 soils are not likely to erode but have other limitations, such as wetness, that are impractical to remove and limit their use.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation.

Class 7 soils have very severe limitations that make them unsuitable for cultivation.

Class 8 soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are designated by adding the letter, "e, w, s," or "c," to the class numeral, for example, 2e. The letter "e" shows the main hazard is the risk of erosion unless a close-growing plant cover is maintained; "w" shows that water in or on the soil interferes with plant growth or cultivation (in some soils wetness can be partly corrected by artificial drainage); "s" shows the soil is limited mainly because it is droughty, stony, or saline; and "c," used in only some parts of the United States, shows the chief limitation is climate that is very cold or very dry.

There are no subclasses in class I because soils of this class have few limitations. Class 5 contains only the subclasses indicated by "w, s," or "c" because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use mainly to pasture, rangeland, woodland, wildlife habitat, or recreation. There are no subclasses in class 8.

Pasture and Hayland Interpretations

Pasture is land devoted to the production of adapted introduced or native forage plants for grazing by livestock. Hayland is land primarily used for the production of hay from long-term stands of adapted forage plants. Both pasture and hayland receive cultural treatments to enhance forage quality and yields. Because of the relatively short growing season, some producers have established cool-season tame

pasture to complement the forage produced on rangeland and to extend the grazing season in the spring and fall.

Generally, large amounts of hay are needed to maintain livestock through the long, harsh winters. Hay was harvested on about 26,000 acres in Ransom County in 1996 (Beard and Waldhaus, 1997).

Proper pasture or hayland management is essential for the production of high-quality forage, stand survival, and erosion control. Proper grazing management on pasture during the growing season helps plants maintain sufficient and vigorous top and root growth for sustained production. Brush and weed control is essential in many areas. Fertilizer increases production and enhances longevity of stands. Rotation grazing and renovation also are important management practices.

Soils are assigned to pasture and hayland groups according to their suitability for production of forage under intensive management. Soils in each suitability group are similar enough to be suited to the same species of grasses or legumes. They also have similar management concerns, productivity levels, and limitations and hazards.

Pasture and hayland suitability groups are given in Table 9, "Interpretive Groupings Report." They are given for drained conditions and, where applicable, undrained conditions. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information on adapted varieties and forage yields.

Pasture and Hayland Groups

The following paragraphs describe the Pasture and Hayland Groups in Major Land Resource Areas (MLRA) 55B and 56 which include Ransom County. They specify the production potential under improved management and list representative adapted species for each group. The notations in parenthesis following the group name are suitability group reference symbols, often used in lieu of the name.

Clayey. (A4) These soils are deep and well, moderately well, and somewhat poorly drained. They are moderately fine and fine textured soils on uplands. They have few limitations for the management and growth of adapted plants. Production potential is high. Suitable forage species include smooth bromegrass, meadow bromegrass, Russian wildrye, Altai wildrye, intermediate and pubescent wheatgrass, crested wheatgrass, hard fescue, western wheatgrass, green needlegrass, slender wheatgrass, switchgrass, and sweetclover.

Clayey Subsoils. (F1) These soils are deep and moderately well and well drained. They are medium to fine textured soils on uplands. They have a claypan that is a moderate restriction to root growth. Otherwise, these soils have few limitations for the management and growth of adapted plants. Production potential is moderate to high. Suitable forage species include crested wheatgrass, smooth bromegrass, Russian wildrye, intermediate and pubescent wheatgrass, western wheatgrass, green needlegrass, alfalfa, and sweetclover.

Claypan. (G1) These soils are deep and somewhat poorly to well drained. They are moderately coarse to fine textured soils on uplands. The claypan is dense with very little root penetration. Typically these soils are strongly alkaline in the claypan and below. These soils are saline below 16 inches. Production potential is low. Suitable forage species include western wheatgrass, slender wheatgrass, crested wheatgrass, alfalfa, and sweetclover.

Limy Subirrigated. (A5) These soils are deep and somewhat poorly drained. They are moderately coarse to moderately fine textured, calcareous soils on uplands. They typically have a water table at about 1.5 to 3.5 feet during spring and early summer. The hazard of wind erosion is a concern during establishment. Production potential is high. Suitable forage species include big bluestem, indiangrass, switchgrass, little bluestem, tall wheatgrass, intermediate and pubescent wheatgrass, slender wheatgrass, alfalfa, birdsfoot trefoil, and sweetclover.

Loamy and Silty. (A1) These soils are deep and mostly well and moderately well drained. They are medium textured soils on uplands. They have few limitations for the management and growth of adapted plants. Production potential is high. Suitable forage species include smooth bromegrass, meadow bromegrass, Russian wildrye, Altai wildrye, intermediate and pubescent wheatgrass, western wheatgrass, switchgrass, indiangrass, big bluestem, thickspike wheatgrass, slender wheatgrass, green needlegrass, alfalfa, and sweetclover.

Moderately Deep Silty. (F2) These soils are moderately deep and well drained. They are medium and moderately fine textured soils on uplands. Weathered siltstone or shale bedrock is at depths of 20 to 40 inches. Root penetration is limited by bedrock. Production potential is moderate to high. Suitable forage species include smooth bromegrass, Russian wildrye, intermediate and pubescent wheatgrass, crested wheatgrass, western wheatgrass, slender wheatgrass, green needlegrass, sideoats grama, alfalfa, and sweetclover.

Overflow and Run-On. (A3) These soils are deep and well to moderately well drained. They are moderately coarse to fine textured soils on flood plains or upland swales and drainageways. Landscapes are typically plane or concave and receive run-on water from adjacent areas. Some soils are subject to flooding. Soils in this group have few limitations for adapted plants. Production potential is high. Suitable forage species include smooth bromegrass, meadow bromegrass, intermediate and pubescent wheatgrass, Russian wildrye, Altai wildrye, western wheatgrass, thickspike wheatgrass, green needlegrass, slender wheatgrass, big bluestem, indiangrass, switchgrass, alfalfa, and sweetclover.

Saline. (G4) These soils are deep and somewhat poorly and poorly drained. They are coarse to fine textured, saline soils surrounding depressions and on flood plains. The available water capacity is moderate because of salinity. Adapted plant species are those with moderate to high salt tolerance. Severely affected areas will need to be seeded and then mulched to reduce salt concentrations during seedling establishment. The better suited forage species include tall wheatgrass, western wheatgrass, thickspike wheatgrass, slender wheatgrass, streambank wheatgrass, alkali sacaton, alsike clover, and sweetclover. Late fall, dormant seedings are recommended.

Sands. (A7) These soils are deep and moderately well to excessively drained. They are coarse textured soils on uplands and flood plains. Wind erosion is a severe hazard during establishment and renovation. Production potential is moderate to high. Species selection is limited for pasture and hayland. Suitable forage species include sand bluestem, switchgrass, prairie sandreed, intermediate and pubescent wheatgrass, and alfalfa.

Sands Soils. (H5) These soils are deep and moderately well to excessively drained. They are very sandy soils on uplands. The soils have a severe wind erosion hazard and are very droughty. They are low in organic matter and very fragile. Blowouts are common. These soils are not suited to pasture and hayland planting. Cultivated areas should be converted to rangeland.

Sandy. (A6) These soils are deep and well and moderately well drained. They are moderately coarse textured soils on uplands and flood plains. The hazard of wind erosion is a concern during establishment and renovation. Production potential is high. Species selection is somewhat limited. Suitable forage species include green needlegrass, western wheatgrass, slender wheatgrass, sand bluestem, prairie sandreed, switchgrass, intermediate and pubescent wheatgrass, alfalfa, and sweetclover.

Shallow. (H4) These soils are shallow and well to excessively drained. They are coarse to fine textured soils on uplands. They are less than 20 inches to weathered bedrock and have a severe water erosion hazard. They are not suited to pasture and hayland plantings. Cultivated areas should be converted to rangeland.

Shallow to Gravel. (B1) These soils are deep and well to excessively drained. They are medium to coarse textured soils on outwash plains. They typically have gravel and/or coarse sand at depths from 14 to 24 inches. These soils are droughty. Production potential is moderate. Only drought-tolerant species such as western wheatgrass, crested wheatgrass, intermediate and pubescent wheatgrass, alfalfa, and sweetclover should be planted.

Sodic-Saline. (G3) These soils are deep and poorly drained. They are moderately coarse to fine textured claypan soils. These soils occur in drainageways, basins, and upland depressions. They typically are strongly alkaline and saline. Plant selection is limited because of wetness, salinity, and alkalinity. Production potential ranges from low to moderate. Establishment is difficult, so mulching is recommended on more severely affected areas. Suitable forage species include tall wheatgrass, western wheatgrass, slender wheatgrass, streambank wheatgrass, switchgrass, alkali sacaton, alsike clover, and sweetclover. Late fall, dormant seedings are recommended.

Steeply Sloping. (H3) These soil areas are on slopes that average 25 percent or greater. Water erosion is a very severe hazard. These soils are not suited to pasture and hayland plantings. Cultivated areas should be converted to rangeland.

Stony. (H2) These are very stony and extremely stony soils. They are not suited to pasture and hayland plantings. Cultivated areas that have had stone removal should be treated the same as the non-stony phase of the same soil in regard to pasture and hayland planting.

Strongly Saline. (H1) These are deep, poorly drained, moderately fine textured, strongly saline soils in drainageways and on flood plains. High salinity makes it extremely difficult to establish grass stands. They are not suited to pasture and hayland plantings. Cultivated areas should be converted to rangeland.

Thin Claypan. (G2) These soils are deep and somewhat poorly to well drained. They are medium to fine textured thin claypan soils on uplands. The claypan is very dense with very little root penetration.

Typically they are strongly alkaline in the claypan and below. They are saline within 16 inches of the surface. Production potential is very low to low. Species selection is extremely limited. The best suited forage species include western wheatgrass, slender wheatgrass, crested wheatgrass, and alfalfa. Where cultivated, returning these soils to rangeland may be a better alternative than pasture or hayland.

Thin Upland. (A2) These soils are deep and well and excessively drained. They are medium textured soils on uplands. They are on ridges, knobs, and other convex positions subject to runoff. The hazards of wind and water erosion are a concern during establishment. Production potential is moderate. Suitable forage species include intermediate and pubescent wheatgrass, crested wheatgrass, western wheatgrass, green needlegrass, prairie sandreed, little bluestem, sideoats grama, alfalfa, and sweetclover

Very Shallow to Gravel. (B2) These soils are deep and well to excessively drained. They are medium to moderately coarse textured soils on outwash plains and scoria topped buttes. They typically have coarse sand and gravel or shattered porcelanite at depths of less than 14 inches. These soils are very droughty. Production potential is low and species selection is severely limited. Suitable species include crested wheatgrass, western wheatgrass, thickspike wheatgrass, and slender wheatgrass. Where cultivated, returning these soils to rangeland may be a better alternative than pasture or hayland.

Wet. (C1) These soils are deep and poorly drained. They are coarse to fine textured soils on flood plains or low areas on till and lake plains. Wetness limits selection of locally adapted forage plants. Production potential is high to very high. Select plant species on the basis of flooding tolerance or inundation tolerance. Suitable species include reed canarygrass, creeping foxtail, big bluestem, switchgrass, indiangrass, western wheatgrass, intermediate and pubescent wheatgrass, smooth bromegrass, tall wheatgrass, and alsike clover.

Wetland. (H6) These soils are deep and very poorly drained. They are coarse to fine textured soils. They are usually too wet for cultivation and are not suited to pasture and hayland plantings unless drained. If drained, treat the same as the Wet pasture and hayland group.

Management of Saline and Sodic Soils

Saline and sodic soils make up over 1.5 percent of Ransom County. Saline soils make up about 0.5 percent of the area, or about 2,300 acres; sodic soils make up about 0.4 percent of the area, or about 2,150 acres; and saline-sodic soils make up about 0.7 percent of the area or about 3,900 acres.

Saline soils have a high concentration of soluble salts, or salts that dissolve in water. Saline soils in Ransom County are phases of the Glyndon and Vallers series.

Saline soils generally develop in areas of restricted drainage, such as those adjacent to sloughs and waterways. Where drainage is poor, salts rise with the water table and are concentrated near the surface. This salt buildup is reduced by plants and a surface cover. The plant roots use the soil water before it can reach the surface and before the salts accumulate. The surface cover prevents evaporation at the surface, the upward movement of water in the soil, and the concentration of salts at the surface (Seelig and Richardson, 1991).

Plants growing on saline soils absorb salts from the soil water. Excess amounts of certain salts may interfere with plant growth. High concentrations of some salts are toxic to certain plants. Some salts cause nutritional imbalances or deficiencies by restricting the uptake or availability of certain plant nutrients. Detecting salinity by visual observations in the field is difficult. The salts are generally not visible during much of the growing season, particularly when the soil is moist. Flecks, threads, or masses of soluble salts are usually visible when the soil is dry(fig. 11). Laboratory analysis or special field instruments are needed to determine the actual degree of salinity in soils.

Crop response, particularly during periods of soil moisture stress, is a useful indicator of the degree of salinity in saline soils. For instance, a small grain crop growing on saline soils tends to be stunted and has fewer tillers than small grain on nonsaline soils. Strongly saline soils are best suited to native grasses or to salt-tolerant introduced grasses. Slightly saline or moderately saline soils can produce salt-tolerant crops and forage. Barley is the most salt-tolerant of the small grains. Of the forage crops, tall wheatgrass, western wheatgrass, and alfalfa are salt tolerant once they are established. Continuous cropping is beneficial because it reduces evaporation and salt accumulation in the surface layer.

Sodic soils are characterized by a high content of exchangeable sodium which adheres to the clay particles in the soil (Seelig and Richardson, 1991). The sodic soils in Ransom County are phases of the Cathay, Cresbard, Exline, Larson, Lemert, and Letcher series. Locally, sodic soils are known as "black alkali," "slick spots," "pan spots" or "gumbo."

Figure 11. An area of Vallers loam, saline. Bare areas and white salt crusts are commonly found in this map unit.

Sodic soils develop in a complex pattern with a very distinct microrelief. The physical and chemical properties of these soils differ markedly within very short distances. In many areas the distance between the sodic soils and the surrounding soils that have normal physical properties is only a few feet.

Sodic soils developed in areas of saline soils that contained large quantities of sodium salts. Over a long period, usually centuries, as the water table lowers, precipitation gradually leaches the salts from the surface to lower horizons. During this leaching process, the clay in the soil becomes saturated with sodium, disperses, and moves downward with the percolating water. As the moving clay concentrates, a dense, sodic subsoil forms (fig. 12). The dense subsoil is hard when dry, sticky when wet, and nearly impervious to roots, water, and air. Examples are the Cavour, Exline, and Lemert soils.

As the leaching by soil water continues, the sodium is gradually moved lower in the soil profile and eventually is carried below rooting depth. The result is a more manageable soil, such as Cathay and Cresbard. If the leaching process continues and nearly all of the sodium is removed from the profile, the soil eventually changes into a nonsodic soil. This change requires a long period, usually centuries.

If plowed, sodic soils are characterized by a surface layer that is sticky when wet and hard and cloddy when dry. A crust forms easily at the surface. The chemical and physical properties of these soils are unfavorable for plant growth. The harmful effects of the properties on plants generally increase as the sodium content increases. The effects of the reduced amount of water available to plants are more harmful than the toxic effect of the sodium. The plants also are affected by the depth to the dense subsoil.

Identification of sodic soils in cultivated fields commonly is difficult because many of the physical characteristics, such as columnar structure, have been altered by tillage. Crop response, particularly during periods of soil moisture stress, is a useful indicator of the level of sodicity in a soil. Crops grown on soils with varying amounts of sodium exhibit varying heights and stages of development. If the level of sodicity is very high, the crop cannot grow. The effects of sodium on crop growth are influenced by weather conditions, stage of crop growth, and soil moisture status. A measure of the effect of sodicity on vegetative growth is not necessarily a reliable measure of crop yields. In many areas the yields of barley and wheat are affected less than the vegetative growth of these crops.

Variability of sodic soils can cause management problems. Soils that have a dense, sodic subsoil near the surface, such as Lemert, are better suited to grass than to small grain and sunflower. Timely tillage is an important management need in areas of sodic soils.

Figure 12. A dense sodic subsoil restricts the penetration of roots.

These areas should be tilled and seeded only when the moisture content is favorable. If worked when too wet, the soils puddle and crust. If the soils are tilled when too dry, tillage and seeding implements cannot easily penetrate the soils. Deep plowing and chemical amendments can help to reclaim sodic soils, but they may not be feasible. To be effective, deep tillage should reach below the sodic subsoil and mix several inches of the underlying material with the subsoil and topsoil. Depending on the soil, tillage to a depth of 15 to 36 inches may be needed. Any reclamation of sodic soils is a long-term endeavor. Complete reclamation may never be achieved. Onsite investigation is needed to confirm the feasibility of deep tillage in a particular area.

Saline-sodic soils develop in areas of restricted drainage where salts rise with the water table but where some downward leaching of clay and some saturation with sodium are evident and a dense, sodic subsoil has formed. An example is the Stirum soil. The management needs and crop responses on these soils are a combination of those on saline soils and those on sodic soils.

Additional information about management or reclamation of saline and sodic soils is available from the Natural Resources Conservation Service, the North Dakota Agricultural Experiment Station, and the Cooperative Extension Service (Franzen, et. al., 1994).

Soil Quality

Definition of Soil Quality

Soil quality is the ability of a soil to function within its surroundings, support plant and animal productivity, and maintain or enhance water and air quality. This is also referred to as soil health.

Functions of Soil

Soil is a living, dynamic resource. It has biological, chemical, and physical properties which are continually changing. Soil provides a physical, chemical, and biological environment for the exchange of water, air, and nutrients necessary for living organisms.

Soil controls the movement of rainfall or irrigation water on the land. Some of the water runs off the soil and directly enters surface water drainage systems. The remaining water either evaporates or infiltrates the soil. There it is stored and used for plant growth or percolates through the soil into the ground water. This control of water flow affects the movement of soluble materials, such as nitrate nitrogen and pesticides, through the environment.

Soil regulates biological activity and chemical exchanges. This affects nutrient cycling, plant growth, and decomposition of organic materials. Soil also acts as a filter to protect the quality of water and air. It provides mechanical support and a rooting environment for living organisms.

Soil quality can be viewed in two ways: In the first view, some soils are better suited than others to perform specific functions. For example, soils that are shallow to bedrock are poorly suited for supporting deep-rooted crops or trees. Soils high in sand and gravel content may have an inherently poor quality for filtering septic system wastes. Alternatively, these same soils may have a high quality or suitability for road and street construction. This view of soil quality is useful when comparing soils and is often used to evaluate the suitability of soils for specific uses.

The second view of soil quality relates to the dynamic nature of soils. Even though a soil may have a certain ability or level of quality for a specific activity, it may be functioning at a level below its inherent capability. This may be due to past disturbance or

current management systems. For example, a farming system that does not protect the surface layer from erosion may result in soil erosion and loss of organic matter, nutrients, and other beneficial properties. In most cases, the eroded soil functions at less than its original potential for production. Its condition or health is considered impaired or lower in quality. In another example, a soil in a wetland, if drained or covered with sediment from nearby uplands, may not serve as effectively as a filter as it would in its natural condition.

Importance of Soil Quality to Landowners

Soil quality has a direct affect on plant growth and productivity for crop, range, hay, and woodland production. It affects how water moves into and through the soil. Maintaining or enhancing soil quality can help reduce the negative effects of soil erosion. Increasing soil quality can reduce the movement of nitrates and other chemicals to adjacent water bodies and ground water. Maintaining a high level of soil quality will ensure the soil resource is sustained for the future.

Many soils have undergone a degradation of their inherent quality through past agricultural operations. However, improved management practices, such as conservation tillage, implementing nutrient and moisture management systems, and establishment of riparian buffers or windbreaks can improve soil quality. As a rule, management practices that maintain a vegetative cover on the soil, return the maximum practical amount of residue, and minimize soil disturbance (tillage), will result in higher levels of soil quality.

Degradation of soil quality can have negative effects on the soil resource and costly offsite impacts. Soil erosion and the consequential deposition of sediment by wind or water are examples. Other negative effects of soil degradation include: compaction and loss of granular structure of surface soil layers, reduction of infiltration rates and organic matter levels, and formation of surface crusts. Degradation of soils can also lead to nutrient loss or imbalances, pesticide carryover, and reduced biological activity.

Soil Quality Indicators

The quality of most soils can be improved over time if managed properly. Key indicators of soil quality can be observed and monitored periodically to ensure the quality of the soil is maintained or enhanced.

Soil quality indicators are soil properties or processes that can be monitored to establish changes in the soil. Indicators can be categorized into four general groups: visual (sensory), physical, chemical, and biological.

Visual indicators may be obtained from observation or photographic interpretation. Exposure of subsoils, change in soil color, ephemeral gullies, ponding, plant response, and surface crusting are a few examples. Visual evidence can be a clear indication that soil quality is changing in either a negative or a positive way. The senses of feel and smell can also be used to evaluate certain soil properties.

Physical indicators are usually obtained by observation or field and laboratory analyses. They include topsoil thickness, bulk density, porosity, aggregate stability, texture, crusting, and compaction. These indicators reflect factors affecting root growth, soil biological activity, seedling emergence, and infiltration and movement of water and air within the soil.

Chemical indicators usually require sampling and field or laboratory analyses. They include measurements of pH, salinity, organic matter, phosphorus concentrations, cation-exchange capacity, and nutrients. The chemical condition of soil affects soil-plant relationships, water quality, buffering capacities, and mobility of nutrients and contaminants.

Biological indicators may be obtained by observation or measurement. They include measurements of micro- and macro-organisms and their activities. Respiration rates to detect microbial decomposition of organic matter and populations of bacteria, fungi, earthworms, nematodes, and mites can be used as biological indicators of soil quality.

Soil quality can be monitored through observation and/or measurement of key soil quality indicators. Soil quality score cards and a test kit (USDA-Soil Quality Institute, 1998) are available to assist in the assessment process. The monitoring program should include several indicators and take into consideration the time of year that sites are monitored, stage of crop growth, and location within the field where observations are made.

Monitoring soil quality should primarily be used to detect trends that are measurable over a 1- to 10-year period. Monitoring trends determines whether the soil is improving, degrading, or remaining steady under the current management system. This allows land managers to detect problems before undesired and possibly irreversible loss of soil quality occurs.

The local office of the Natural Resources Conservation Service, Soil Conservation District, or Cooperative Extension Service can help establish a plan for monitoring soil quality.

Woodland, Windbreaks, and Environmental Plantings

Ransom County has approximately 15,900 acres of native woodland (Jakes and Smith, 1982). Most of this woodland is found on the north-facing slopes on sand hills in the Sheyenne River National Grasslands and in the valleys of the Sheyenne River and its tributaries. The wooded area on the sand hills is primarily on Serden, Venlo, and Hamar soils. The woodland on the bottom lands is mostly on areas of LaDelle, La Prairie, and Fairdale soils (fig. 13).

The woodland type on the sand hills of the Sheyenne National Grassland is mostly bur oak. Other less common species may include green ash, hackberry, American elm, basswood, and boxelder. The understory species include beaked hazel, gooseberry, common chokecherry, hawthorn, sumac, buckbrush, wild plum, and prickly ash.

The forest type along the Sheyenne River is divided into two main types. The woodland on the side slopes is primarily bur oak and green ash. Green ash predominates on the lower slopes with bur oak dominating the upper slopes. Other trees and shrubs associated with these major tree species are common chokecherry and snowberry. The bottom land forest type is primarily American elm and green ash. Other less common species include bur oak, boxelder, American basswood, hackberry, and ironwood. The understory vegetation includes gooseberry, prickly ash, and common chokecherry.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens and furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow tree/shrub rows interspersed with cropland at specified intervals. Field windbreaks oriented perpendicular to the prevailing winds are the most efficient. Intervals depend on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and abate noise. The plants, mostly evergreen shrubs and trees, are closely

Figure 13. An area of La Prairie soils on flood plains of the Sheyenne River. Note hardwood trees adjacent to stream channel.

spaced. To ensure plant survival, a healthy planting stock of suitable species should be properly planted on a well prepared site and maintained in good condition.

The following items should be considered before a planting is made: purpose of the planting, suitability of various species of trees and shrubs to the soils and climate, location and design of the windbreak, and selection of hardy seedlings. Planting stock should be from parent material originally from the Northern Great Plains or southern Canadian Prairie provinces. If these items are not considered, a poor, unsuccessful windbreak may result.

Establishment of a windbreak or an environmental planting and growth of trees and shrubs also depend on suitable site preparation and adequate maintenance after the trees and shrubs are planted. Grasses and weeds should be eliminated before the trees and shrubs are planted and competing ground cover should be controlled for the life of the windbreak. Competition from sod-forming grasses will greatly harm and sometimes kill tree and shrub plantings. Some replanting may be necessary during the first two years after the trees and shrubs are planted.

Windbreaks are often planted on land that did not originally support trees. Knowledge of how trees perform on such land can be gained only by observing and recording the performance of trees that have been planted and survived. Many popular windbreak species are not indigenous to the areas in which they are planted.

Each tree or shrub species has certain climatic and physiographic limits. Within these parameters, a tree or shrub may grow well or grow poorly, depending on the characteristics of the soil.

Windbreak suitability groups consist of soils in which the kinds and degrees of hazards and limitations that affect the survival and growth of trees and shrubs in windbreaks are similar. They are a guide for selecting species best suited for different kinds of soils. Windbreak suitability groups are shown for each soil in Table 9, "Interpretive Groupings Report." They are given for drained conditions and, where applicable, undrained conditions.

Each tree or shrub has definable potential heights in a given physiographic area and under a given climate. Accurate definitions of potential heights are necessary when a windbreak is planned and designed.

Table 10, "Windbreak Suitability Groups," shows the height locally grown trees and shrubs are expected to reach in 20 years on various soils. Estimates in this table are based on measurements and observations of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Natural Resources Conservation Service, the Cooperative Extension Service, or from a nursery.

Windbreak Suitability Groups

The following paragraphs describe the windbreak suitability groups.

Group 1. These are very deep, well to somewhat poorly drained soils that receive beneficial moisture from favorable landscape positions, flooding, or runoff from adjacent land. They may also have a beneficial seasonally high water table during the spring. Competition from grass and weeds is the principal concern in establishing and managing trees and shrubs. Occasionally, somewhat poorly drained soils may have excessive water for some species.

Group 1K. These are very deep, calcareous, well to somewhat poorly drained soils on low rises near wetlands that receive beneficial moisture from favorable landscape positions or have a beneficial seasonally high water table during the spring. High calcium carbonate content will have an effect on the selection of species on soils in this group. Competition from grass and weeds is the principal concern in establishing and managing trees and shrubs. Occasionally, somewhat poorly drained soils may have excessive water for some species. Wind erosion is a concern on these soils.

Group 2. Soils in this group are very deep, poorly or very poorly drained, and excessively wet or ponded during the spring or overflow periods. Wetness and drainage will have an affect on the selection of tree and shrub species for soils in this group. Competition from grass and weeds is the principal concern in establishing and managing trees and shrubs. Spring planting may be delayed because of wet conditions. Wind erosion is a concern on the sandy and organic soils in this group.

Group 2H. Soils in this group are very deep, have an organic mat about 24 inches thick, are poorly or very poorly drained, and are excessively wet or ponded during the spring or overflow periods. Wetness and drainage will have an affect on the selection of tree and shrub species for soils in this group. Competition from grass and weeds is the principal concern in establishing and managing trees and shrubs. Spring planting may be delayed because of wet conditions. Wind erosion is a concern on these soils.

Group 2K. Soils in this group are very deep, calcareous, poorly or very poorly drained, and are on rims of potholes and broad flats that are excessively

wet or ponded during the spring or overflow periods. Wetness, high calcium carbonate content, and drainage will have an affect on the selection of tree and shrub species for soils in this group. Competition from grass and weeds is the principal concern in establishing and managing trees and shrubs. Spring planting may be delayed because of wet conditions. Wind erosion is a concern on these soils.

Group 3. Soils in this group are very deep, well drained, loamy textured soils with moderate and moderately slow saturated hydraulic conductivity on uplands. Competition from grass and weeds is the principal concern in establishing and managing trees and shrubs on these soils. Water erosion is a concern on the gently sloping to moderately steep areas.

Group 4. Soils in this group are moderately deep to very deep, have loamy surface textures with clayey subsoils, have slow or very slow saturated hydraulic conductivity and occur on uplands. High clay content has an affect on the selection of tree and shrub species for these soils. Competition from grass and weeds is the principal concern in establishing and managing trees and shrubs on these soils. Water erosion is a concern on the gently sloping to moderately steep areas.

Group 4C. Soils in this group are moderately deep to very deep, are clayey throughout, have slow or very slow saturated hydraulic conductivity, and occur on uplands. High clay content has an affect on the selection of tree and shrub species for these soils. Competition from grass and weeds is the principal concern in establishing and managing trees and shrubs on these soils. Wind erosion is a concern on these soils and water erosion is a concern on the gently sloping to moderately steep areas.

Group 5. Soils in this group are very deep with loamy and sandy textures. This group typically includes soils that normally have adequate soil moisture. Competition from grass and weeds and abrasion from wind erosion are the principal concerns in establishing and managing trees and shrubs on these soils.

Group 6D. Soils in this group are well drained, mostly loamy textured, and moderately deep over bedrock and other cemented layers that can severely restrict root growth. They have low or moderate available water capacity. Droughtiness will have an affect on the selection of tree and shrub species for use on these soils. Competition from grass and weeds is the principal concern in establishing and managing trees and shrubs on these soils. Water erosion is a concern on the gently sloping to moderately steep areas. Supplemental watering may be needed for establishment.

Group 6G. Soils in this group are well drained, mostly loamy textured, and moderately deep over sand and gravel. The sand and gravel can restrict root growth and reduce available water capacity. Droughtiness will have an affect on the selection of tree and shrub species for use on these soils. Competition from grass and weeds is the principal concern in establishing and managing trees and shrubs on these soils. Water erosion is a concern on the gently sloping to moderately steep areas. Supplemental watering may be needed for establishment.

Group 7. Soils in this group are very deep, excessively to moderately well drained, and sandy textured. They typically have low to very low available water capacity and do not normally have adequate moisture. Drought conditions and abrasion from wind erosion are the principal concerns in establishing and managing trees and shrubs on these soils. Specialized site preparation and planting methods (vegetation between the rows is normally left undisturbed) are needed to establish trees and shrubs. Supplemental watering may be essential for successful establishment.

Group 8. Soils in this group are calcareous at or near the surface. They do not receive beneficial moisture from run-on, flooding, or seasonal high water tables. High calcium carbonate content and competition from grass and weeds are the principal concerns in establishing and managing trees and shrubs on these soils. Wind erosion is a concern on these soils and water erosion is a concern on gently sloping to moderately steep areas.

Group 9C. Soils in this group are clayey and affected by salinity and/or sodicity. These soils do not have a seasonal high water table. Concentrations of salt will severely affect the establishment, vigor, and growth of trees and shrubs on these soils.

Group 9L. Soils in this group are loamy and affected by salinity and/or sodicity. These soils do not have a seasonal high water table. Concentrations of salt will severely affect the establishment, vigor, and growth of trees and shrubs on these soils.

Group 9W. Soils in this group are affected by salinity and/or sodicity and have a high water table. Concentrations of salt will severely affect the establishment, vigor, and growth of trees and shrubs on these soils.

Group 10. Soils in this group have one or more characteristics such as soil depth, texture, drainage, channeled phases, available water capacity, slope, or

salt toxicity which severely limit planting, survival, or growth of trees and shrubs. Soils in this group are usually not recommended for farmstead and feedlot windbreaks, field windbreaks, and plantings for recreation and wildlife. However, onsite investigations may reveal tree and shrub plantings can be made with special treatments (hand planting, no-till planting, scalp planting, specialized site preparation, drainage, or other specialized treatments). Selection of species must be tailored to soil conditions existing at each site.

All soils on moderately steep, steep, or very steep slopes (generally 15 percent or greater) and soils that are generally too wet, too shallow, or have other severely restrictive conditions fall into group 10. When an onsite investigation reveals a planting can be made on a soil in group 10, species should be selected from the most comparable windbreak suitability group. For example, for a shallow soil over bedrock, trees or shrubs would be selected from group 6D; an excessively wet soil would most closely match group 2.

Table 6.—Potential Cropland Limitations and Hazards

(See text for a description and criteria of the limitations and hazards listed in this table)

Map Symbol and Component Name	Cropland Limitations and Hazards
64:	
Arveson	Alkalinity Excessive saturated hydraulic conductivity High water table Lime content Pesticide and nutrient leaching Surface crusting Wind erosion
76:	
Arvilla	Alkalinity Depth to sand and gravel Excessive saturated hydraulic conductivity Limited available water capacity Pesticide and nutrient leaching Pesticide and nutrient runoff Wind erosion
86:	
Aylmer	Excessive saturated hydraulic conductivity Limited available water capacity Limited organic matter Pesticide and nutrient leaching Wind erosion
Bantry	Excessive saturated hydraulic conductivity High water table Pesticide and nutrient leaching Wind erosion
118:	
Barnes	Pesticide and nutrient runoff
Buse	Alkalinity Lime content Pesticide and nutrient runoff Surface crusting Wind erosion
120:	
Barnes	Pesticide and nutrient runoff Slope Water erosion
Buse	Alkalinity Lime content Pesticide and nutrient runoff Slope Surface crusting Water erosion Wind erosion
154:	
Barnes	None
Svea	Pesticide and nutrient leaching

Table 6.—Potential Cropland Limitations and Hazards--(continued)

(See text for a description and criteria of the limitations and hazards listed in this table)

Map Symbol and Component Name	Cropland Limitations and Hazards
156:	
Barnes	Pesticide and nutrient runoff
Svea	Pesticide and nutrient leaching Pesticide and nutrient runoff
314:	
Buse	Alkalinity Lime content Pesticide and nutrient runoff Slope Surface crusting Water erosion Wind erosion
Barnes	Pesticide and nutrient runoff Slope Water erosion
450:	
Colvin	Alkalinity High water table Lime content Pesticide and nutrient leaching Surface crusting Wind erosion
493:	
Darnen	Pesticide and nutrient runoff
510:	
Divide	Alkalinity Depth to sand and gravel Excessive saturated hydraulic conductivity High water table Lime content Pesticide and nutrient leaching Surface crusting Wind erosion
571:	
Embden	Excessive saturated hydraulic conductivity Limited available water capacity Pesticide and nutrient leaching Pesticide and nutrient runoff Wind erosion
726:	
Fordville	Depth to sand and gravel Excessive saturated hydraulic conductivity Limited available water capacity Pesticide and nutrient leaching

Table 6.—Potential Cropland Limitations and Hazards--(continued)

(See text for a description and criteria of the limitations and hazards listed in this table)

Map Symbol and Component Name	Cropland Limitations and Hazards
772:	
Gardena	Excessive saturated hydraulic conductivity Pesticide and nutrient leaching
Eckman	None
794:	
Glyndon	Alkalinity Excessive saturated hydraulic conductivity High water table Lime content Pesticide and nutrient leaching Surface crusting Wind erosion
795:	
Glyndon, saline	Alkalinity Excessive saturated hydraulic conductivity High water table Lime content Pesticide and nutrient leaching Salt content Surface crusting Wind erosion
852:	
Hamar	Excessive saturated hydraulic conductivity High water table Pesticide and nutrient leaching Pesticide and nutrient runoff Ponding Wind erosion
883:	
Hamerly	Alkalinity High water table Lime content Pesticide and nutrient leaching Pesticide and nutrient runoff Surface crusting Wind erosion
Tonka	High water table Pesticide and nutrient leaching Pesticide and nutrient runoff Ponding Restricted saturated hydraulic conductivity
Parnell	High water table Pesticide and nutrient leaching Pesticide and nutrient runoff Ponding Poor tilth and compaction Restricted saturated hydraulic conductivity

Table 6.—Potential Cropland Limitations and Hazards--(continued)

(See text for a description and criteria of the limitations and hazards listed in this table)

Map Symbol and Component Name	Cropland Limitations and Hazards
939:	
Hecla	Excessive saturated hydraulic conductivity Limited available water capacity Pesticide and nutrient leaching Wind erosion
Hamar	Excessive saturated hydraulic conductivity High water table Pesticide and nutrient leaching Wind erosion
1030:	
Kranzburg	Pesticide and nutrient runoff
Lismore	Pesticide and nutrient leaching Pesticide and nutrient runoff
1043:	
La Prairie	Pesticide and nutrient leaching Surface crusting
1055:	
LaDelle	Pesticide and nutrient leaching Surface crusting
1081:	
Lamoure	Alkalinity High water table Lime content Pesticide and nutrient leaching Surface crusting Wind erosion
1168:	
Lismore	Pesticide and nutrient leaching
Kranzburg	None
1205:	
Maddock	Excessive saturated hydraulic conductivity Limited available water capacity Pesticide and nutrient leaching Pesticide and nutrient runoff Slope Water erosion Wind erosion
1221:	
Maddock	Excessive saturated hydraulic conductivity Limited available water capacity Pesticide and nutrient leaching Wind erosion
Hecla	Excessive saturated hydraulic conductivity Limited available water capacity Pesticide and nutrient leaching Wind erosion

Table 6.—Potential Cropland Limitations and Hazards--(continued)

(See text for a description and criteria of the limitations and hazards listed in this table)

Map Symbol and Component Name	Cropland Limitations and Hazards
1269:	
Marysland	Alkalinity Depth to sand and gravel Excessive saturated hydraulic conductivity High water table Lime content Pesticide and nutrient leaching Surface crusting Wind erosion
1403:	
Overly	Pesticide and nutrient leaching
1427:	
Parnell	High water table Pesticide and nutrient leaching Pesticide and nutrient runoff Ponding Poor tilth and compaction Restricted saturated hydraulic conductivity
1466:	
Pits, gravel and sand	Alkalinity Depth to sand and gravel Excessive saturated hydraulic conductivity Lime content Limited available water capacity Limited organic matter Pesticide and nutrient leaching Pesticide and nutrient runoff Slope Surface rock fragments Water erosion
1472:	
Rauville	Alkalinity Flooding High water table Lime content Pesticide and nutrient leaching Pesticide and nutrient runoff Surface crusting Wind erosion
1523:	
Renshaw	Depth to sand and gravel Excessive saturated hydraulic conductivity Limited available water capacity Pesticide and nutrient leaching
1560:	
Rifle	Excessive saturated hydraulic conductivity High water table Pesticide and nutrient leaching Pesticide and nutrient runoff Ponding

Table 6.—Potential Cropland Limitations and Hazards--(continued)

(See text for a description and criteria of the limitations and hazards listed in this table)

Map Symbol and Component Name	Cropland Limitations and Hazards
1577:	
Rosewood	Alkalinity Excessive saturated hydraulic conductivity High water table Lime content Pesticide and nutrient leaching Surface crusting Wind erosion
1648:	
Serden	Excessive saturated hydraulic conductivity Limited available water capacity Limited organic matter Pesticide and nutrient leaching Pesticide and nutrient runoff Slope Water erosion Wind erosion
Duneland	Excessive saturated hydraulic conductivity High water table Limited organic matter Pesticide and nutrient leaching Pesticide and nutrient runoff Poor tilth and compaction Slope Water erosion Wind erosion
1670:	
Ulen	Alkalinity Excessive saturated hydraulic conductivity High water table Lime content Pesticide and nutrient leaching Surface crusting Wind erosion
Rosewood	Alkalinity Excessive saturated hydraulic conductivity High water table Lime content Pesticide and nutrient leaching Surface crusting Wind erosion
1704:	
Sioux	Alkalinity Depth to sand and gravel Excessive saturated hydraulic conductivity Lime content Limited available water capacity Pesticide and nutrient leaching Wind erosion
Renshaw	Depth to sand and gravel Excessive saturated hydraulic conductivity Limited available water capacity Pesticide and nutrient leaching Pesticide and nutrient runoff

Table 6.--Potential Cropland Limitations and Hazards--(continued)

(See text for a description and criteria of the limitations and hazards listed in this table)

Map Symbol and Component Name	Cropland Limitations and Hazards
1709:	
Southam	Alkalinity High water table Lime content Pesticide and nutrient leaching Pesticide and nutrient runoff Ponding Poor tilth and compaction Restricted saturated hydraulic conductivity Salt content Surface crusting Wind erosion
1772:	
Svea	Pesticide and nutrient leaching
Gardena	Excessive saturated hydraulic conductivity Pesticide and nutrient leaching Surface crusting
1788:	
Swenoda	Excessive saturated hydraulic conductivity Pesticide and nutrient leaching Pesticide and nutrient runoff Wind erosion
Barnes	Pesticide and nutrient runoff
1834:	
Tonka	High water table Pesticide and nutrient leaching Pesticide and nutrient runoff Ponding Restricted saturated hydraulic conductivity
1842:	
Towner	Excessive saturated hydraulic conductivity Limited available water capacity Pesticide and nutrient leaching Pesticide and nutrient runoff Wind erosion
1859:	
Ulen	Alkalinity Excessive saturated hydraulic conductivity High water table Lime content Pesticide and nutrient leaching Surface crusting Wind erosion
1871:	
Vallers, saline	Alkalinity High water table Lime content Pesticide and nutrient leaching

Table 6.—Potential Cropland Limitations and Hazards--(continued)

(See text for a description and criteria of the limitations and hazards listed in this table)

Map Symbol and Component Name	Cropland Limitations and Hazards
1871: (con't)	
Vallers, saline	Salt content Surface crusting Wind erosion
1883:	
Vallers	Alkalinity High water table Lime content Pesticide and nutrient leaching Surface crusting Wind erosion
Parnell	High water table Pesticide and nutrient leaching Pesticide and nutrient runoff Ponding Poor tilth and compaction Restricted saturated hydraulic conductivity
1935:	
Venlo	Excessive saturated hydraulic conductivity High water table Pesticide and nutrient leaching Pesticide and nutrient runoff Ponding Wind erosion
1953:	
Wahpeton	Lime content Pesticide and nutrient leaching Pesticide and nutrient runoff Poor tilth and compaction Wind erosion
1978:	
Water	Non-soil material
2049:	
Wyndmere	Alkalinity Excessive saturated hydraulic conductivity High water table Lime content Pesticide and nutrient leaching Surface crusting Wind erosion
2091:	
Zell	Alkalinity Lime content Pesticide and nutrient runoff Slope Surface crusting Water erosion Wind erosion

Table 6.—Potential Cropland Limitations and Hazards--(continued)

(See text for a description and criteria of the limitations and hazards listed in this table)

Map Symbol and Component Name	Cropland Limitations and Hazards
2206:	
Barnes	Pesticide and nutrient runoff Slope Water erosion
Sioux	Alkalinity Depth to sand and gravel Excessive saturated hydraulic conductivity Lime content Limited available water capacity Pesticide and nutrient leaching Pesticide and nutrient runoff Slope Wind erosion
2207:	
Bearden	Alkalinity Excessive saturated hydraulic conductivity High water table Lime content Pesticide and nutrient leaching Surface crusting Wind erosion
2208:	
Brantford	Depth to sand and gravel Excessive saturated hydraulic conductivity Limited available water capacity Pesticide and nutrient leaching
Coe	Depth to sand and gravel Excessive saturated hydraulic conductivity Lime content Limited available water capacity Pesticide and nutrient leaching Surface crusting Wind erosion
2209:	
Buse	Alkalinity Lime content Pesticide and nutrient runoff Slope Surface crusting Water erosion Wind erosion
Barnes	Pesticide and nutrient runoff Slope Water erosion
2210:	
Cathay	Pesticide and nutrient leaching Restricted saturated hydraulic conductivity Root limiting Surface stones
Larson	High sodium content Limited available water capacity Pesticide and nutrient leaching

Table 6.—Potential Cropland Limitations and Hazards--(continued)

(See text for a description and criteria of the limitations and hazards listed in this table)

Map Symbol and Component Name	Cropland Limitations and Hazards
2210: (con't)	
Larson	Poor tilth and compaction Restricted saturated hydraulic conductivity Salt content Surface crusting Surface stones
2211:	
Eckman	Pesticide and nutrient runoff
Gardena	Excessive saturated hydraulic conductivity Pesticide and nutrient leaching Pesticide and nutrient runoff
2212:	
Eckman	Pesticide and nutrient runoff
Zell	Alkalinity Lime content Pesticide and nutrient runoff Surface crusting Wind erosion
2213:	
Eckman	Pesticide and nutrient runoff Slope Water erosion
Zell	Alkalinity Lime content Pesticide and nutrient runoff Slope Surface crusting Water erosion Wind erosion
2214:	
Exline	High sodium content High water table Lime content Pesticide and nutrient leaching Poor tilth and compaction Restricted saturated hydraulic conductivity Salt content Surface crusting
2215:	
Fairdale	Lime content Pesticide and nutrient leaching Pesticide and nutrient runoff Surface crusting Wind erosion
2216:	
Gwinner	Pesticide and nutrient leaching Pesticide and nutrient runoff Poor tilth and compaction Restricted saturated hydraulic conductivity

Table 6.—Potential Cropland Limitations and Hazards--(continued)

(See text for a description and criteria of the limitations and hazards listed in this table)

Map Symbol and Component Name	Cropland Limitations and Hazards
2216: (con't)	
Peever	Pesticide and nutrient runoff Poor tilth and compaction Restricted saturated hydraulic conductivity
Parnell	High water table Pesticide and nutrient leaching Pesticide and nutrient runoff Ponding Poor tilth and compaction Restricted saturated hydraulic conductivity
2217:	
Hamerly	Alkalinity High water table Lime content Pesticide and nutrient leaching Pesticide and nutrient runoff Surface crusting Wind erosion
Buse	Alkalinity Lime content Pesticide and nutrient runoff Surface crusting Wind erosion
Parnell	High water table Pesticide and nutrient leaching Pesticide and nutrient runoff Ponding Poor tilth and compaction Restricted saturated hydraulic conductivity
2218:	
Brantford	Depth to sand and gravel Excessive saturated hydraulic conductivity Limited available water capacity Pesticide and nutrient leaching
Vang	Depth to sand and gravel Excessive saturated hydraulic conductivity Limited available water capacity Pesticide and nutrient leaching
2219:	
Hegne	Alkalinity High water table Lime content Pesticide and nutrient leaching Poor tilth and compaction Restricted saturated hydraulic conductivity Surface crusting Wind erosion
2220:	
Letcher	Excessive saturated hydraulic conductivity High sodium content

Table 6.—Potential Cropland Limitations and Hazards--(continued)

(See text for a description and criteria of the limitations and hazards listed in this table)

Map Symbol and Component Name	Cropland Limitations and Hazards
2220: (con't)	
Letcher	Limited available water capacity
	Pesticide and nutrient leaching
	Restricted saturated hydraulic conductivity
	Wind erosion
Lemert	Alkalinity
	High sodium content
	High water table
	Pesticide and nutrient leaching
	Poor tilth and compaction
	Restricted saturated hydraulic conductivity
	Salt content
	Surface crusting
	Wind erosion
2221:	
Falsen	Excessive saturated hydraulic conductivity
	Limited available water capacity
	Pesticide and nutrient leaching
	Wind erosion
2222:	
Peever	Pesticide and nutrient runoff
	Poor tilth and compaction
	Restricted saturated hydraulic conductivity
Gwinner	Pesticide and nutrient leaching
	Pesticide and nutrient runoff
	Poor tilth and compaction
	Restricted saturated hydraulic conductivity
2223:	
Renshaw	Depth to sand and gravel
	Excessive saturated hydraulic conductivity
	Limited available water capacity
	Pesticide and nutrient leaching
	Pesticide and nutrient runoff
Sioux	Alkalinity
	Depth to sand and gravel
	Excessive saturated hydraulic conductivity
	Lime content
	Limited available water capacity
	Pesticide and nutrient leaching
	Wind erosion
2224:	
Serden	Excessive saturated hydraulic conductivity
	Limited available water capacity
	Limited organic matter
	Pesticide and nutrient leaching
	Pesticide and nutrient runoff
	Slope
	Water erosion
	Wind erosion

Table 6.—Potential Cropland Limitations and Hazards--(continued)

(See text for a description and criteria of the limitations and hazards listed in this table)

Map Symbol and Component Name	Cropland Limitations and Hazards
2224: (con't)	
Hamar	Excessive saturated hydraulic conductivity High water table Pesticide and nutrient leaching Pesticide and nutrient runoff Ponding Wind erosion
2225:	
Sioux	Alkalinity Depth to sand and gravel Excessive saturated hydraulic conductivity Lime content Limited available water capacity Pesticide and nutrient leaching Pesticide and nutrient runoff Slope Surface rock fragments Water erosion
2226:	
Stirum	Alkalinity Excessive saturated hydraulic conductivity High sodium content High water table Lime content Pesticide and nutrient leaching Pesticide and nutrient runoff Ponding Poor tilth and compaction Restricted saturated hydraulic conductivity Salt content Surface crusting Wind erosion
Lemert	Alkalinity High sodium content High water table Pesticide and nutrient leaching Poor tilth and compaction Restricted saturated hydraulic conductivity Salt content Surface crusting Wind erosion
2228:	
Aylmer	Excessive saturated hydraulic conductivity Limited available water capacity Limited organic matter Pesticide and nutrient leaching Wind erosion
Rosewood	Alkalinity Excessive saturated hydraulic conductivity High water table Lime content Pesticide and nutrient leaching Surface crusting Wind erosion

Table 6.—Potential Cropland Limitations and Hazards--(continued)

(See text for a description and criteria of the limitations and hazards listed in this table)

Map Symbol and Component Name	Cropland Limitations and Hazards
2228: (con't)	
Serden	Excessive saturated hydraulic conductivity Limited available water capacity Limited organic matter Pesticide and nutrient leaching Pesticide and nutrient runoff Slope Wind erosion

Table 7.--Map Unit Productivity Index and Farmland Designation

(Absence of an entry indicates that an assignment has not been made. Entries in ( ) are for undrained conditions.)

Map Symbol	Spring Wheat Productivy Index	Farmland Designation
64	64 (42)	Prime farmland where drained
76	41	Other land
86	25	Other land
118	75	Prime farmland
120	59	Additional farmland of statewide importance
154	88	Prime farmland
156	81	Prime farmland
314	42	Other land
450	70 (40)	Prime farmland where drained
493	93	Prime farmland
510	64	Prime farmland
571	69	Prime farmland
726	57	Prime farmland
772	96	Prime farmland
794	89	Prime farmland
795	49	Other land
852	50 (30)	Other land
883	84 (67)	Prime farmland where drained
939	50	Farmland of statewide importance
1030	82	Farmland of statewide importance
1043	93	Prime farmland
1055	96	Prime farmland
1081	67 (38)	Prime farmland where drained
1168	94	Prime farmland
1205	27	Other land
1221	45	Other land
1269	60 (33)	Prime farmland where draind
1403	98	Prime farmland
1427	73 (22)	Other land
1466	8	Other land

Table 7.--Map Unit Productivity Index and Farmland Designation--(continued)

(Absence of an entry indicates that an assignment has not been made. Entries in ( ) are for undrained conditions.)

Map Symbol	Spring Wheat Productivy Index	Farmland Designation
1472	52 (7)	Other land
1523	46	Other land
1560	40 (10)	Other land
1577	53 (31)	Other land
1648	4	Other land
1670	58 (50)	Larmland of statewide importance
1704	31	Other land
1709	54 (4)	Other land
1772	97	Prime farmland
1788	77	Prime farmland
1834	84 (45)	Prime farmland where drained
1842	51	Other land
1859	56	Larmland of statewide importance
1871	36	Other land
1883	70 (41)	Other land
1935	56 (21)	Other land
1953	93	Prime farmland
1978	0	Other land
2049	74	Prime farmland
2091	26	Other land
2206	48	Other land
2207	94	Prime farmland
2208	44	Other land
2209	21	Other land
2210	33	Other land
2211	86	Prime farmland
2212	80	Prime farmland
2213	59	Larmland of statewide importance
2214	30	Other land
2215	80	Prime farmland

Table 7.--Map Unit Productivity Index and Farmland Designation--(continued)

(Absence of an entry indicates that an assignment has not been made. Entries in ( ) are for undrained conditions.)

Map Symbol	Spring Wheat Productivy Index	Farmland Designation
2216	94 (87)	Prime farmland.
2217	76 (63)	Farmland of statewide importance
2218	52	Other land
2219	88 (50)	Prime farmland where drained
2220	35	Other land
2221	40	Other land
2222	86	Prime farmland
2223	42	Other land
2224	21 (14)	Other land
2225	20	Other land
2226	26	Other land
2228	30 (23)	Other land

Table 8.— Yields per Acre of Crops

(Yield estimates are those that can be expected under a high level of management. They are for nonirrigated areas. The presence of a yield does not indicate the soil is suited for cultivated crops. Absence of yield information indicates that the soil is not rated. Entries in () are for undrained conditions.)

Map symbol and soil name	Spring wheat	Oats	Barley	Flax	Sunflowers	Grass-legume hay *
	Bu/A	Bu/A	Bu/A	Bu/A	Lbs/A	T/A
64: Arveson	31 (20)	65 (33)	50 (33)	15 (10)	1540 (1010)	2.3 (2.6)
76: Arvilla	20	42	32	10	980	1.8
86: Aylmer Bantry	12	26	20	6	600	2.2
118: Barnes Buse	36	77	59	18	1800	2.1
120: Barnes Buse	28	60	46	14	1420	2.1
154: Barnes Svea	42	90	69	21	2110	2.7
156: Barnes Svea	39	83	63	19	1940	2.7
314: Buse Barnes	20	43	33	10	1010	1.4
450: Colvin	34 (19)	71 (31)	55 (31)	17 (10)	1680 (960)	2.3 (2.8)
493: Darnen	45	95	73	22	2230	2.8
510: Divide	31	65	50	15	1540	2.3
571: Embden	33	70	54	17	1660	2.1
726: Fordville	27	58	44	14	1370	2.6
772: Gardena Eckman	46	98	75	23	2300	2.3
794: Glyndon	43	91	69	21	2140	2.7
795: Glyndon, saline	24	50	38	12	1180	2.1

Table 8.-- Yields per Acre of Crops--(continued)

(Yield estimates are those that can be expected under a high level of management. They are for nonirrigated areas. The presence of a yield does not indicate the soil is suited for cultivated crops. Absence of yield information indicates that the soil is not rated. Entries in () are for undrained conditions.)

Map symbol and soil name	Spring wheat	Oats	Barley	Flax	Sunflowers	Grass-legume hay *
	Bu/A	Bu/A	Bu/A	Bu/A	Lbs/A	T/A
852: Hamar	24 (14)	51 (23)	39 (23)	12 (7)	1200 (720)	2.8 (2.8)
883: Hamerly Tonka Parnell	40 (32)	86 (52)	66 (52)	20 (16)	2020 (1610)	2.6 (2.1)
939: Hecla Hamar	24	51	39	12	1200	2.2
1030: Kranzburg Lismore	39	84	64	20	1970	2.7
1043: La Prairie	45	95	73	22	2230	2.8
1055: LaDelle	46	98	75	23	2300	2.8
1081: Lamoure	32 (18)	68 (30)	52 (30)	16 (9)	1610 (910)	2.8 (2.8)
1168: Lismore Kranzburg	45	96	73	23	2260	2.7
1205: Maddock	13	28	21	6	650	1.4
1221: Maddock Hecla	22	46	35	11	1080	1.8
1269: Marysland	29 (16)	61 (26)	47 (26)	14 (8)	1440 (790)	2.3 (2.8)
1403: Overly	47	100	76	24	2350	2.6
1427: Parnell	35 (11)	74 (17)	57 (17)	18 (5)	1750 (530)	2.8 (0.5)
1466: Pits, gravel and sand	4	8	6	2	190	0.2
1472: Rauville	25 (3)	53 (5)	41 (5)	12 (2)	1250 (170)	2.0 (0.3)
1523: Renshaw	22	47	36	11	1100	1.8

Table 8.— Yields per Acre of Crops--(continued)

(Yield estimates are those that can be expected under a high level of management. They are for nonirrigated areas. The presence of a yield does not indicate the soil is suited for cultivated crops. Absence of yield information indicates that the soil is not rated. Entries in () are for undrained conditions.)

Map symbol and soil name	Spring wheat	Oats	Barley	Flax	Sunflowers	Grass-legume hay *
	Bu/A	Bu/A	Bu/A	Bu/A	Lbs/A	T/A
1560: Rifle	19 (5)	41 (8)	31 (8)	10 (2)	960 (240)	2.0 (0.3)
1577: Rosewood	25 (15)	54 (24)	41 (24)	13 (7)	1270 (740)	2.8 (2.8)
1648: Serden, Duneland	2	4	3	1	100	0.3
1670: Ulen, Rosewood	28 (24)	59 (39)	45 (39)	14 (12)	1390 (1200)	2.3 (2.5)
1704: Sioux, Renshaw	15	32	24	7	740	1.3
1709: Southam	26 (2)	55 (3)	42 (3)	13 (1)	1300 (100)	2.0 (0.1)
1772: Svea, Gardena	47	99	76	23	2330	2.7
1788: Swenoda, Barnes	37	79	60	18	1850	2.3
1834: Tonka	40 (22)	86 (35)	66 (35)	20 (11)	2020 (1080)	2.8 (2.8)
1842: Towner	24	52	40	12	1220	2.1
1859: Ulen	27	57	44	13	1340	2.3
1871: Vallers	17	37	28	9	860	2.3 (2.8)
1883: Vallers, Parnell	34 (20)	71 (32)	55 (32)	17 (10)	1680 (980)	2.5 (1.9)
1935: Venlo	27 (10)	57 (16)	44 (16)	13 (5)	1340 (500)	2.8 (0.5)
1953: Wahpeton	45	95	73	22	2230	2.2
1978: Water	—	—	—	—	—	—

Table 8.— Yields per Acre of Crops--(continued)

(Yield estimates are those that can be expected under a high level of management. They are for nonirrigated areas. The presence of a yield does not indicate the soil is suited for cultivated crops. Absence of yield information indicates that the soil is not rated. Entries in () are for undrained conditions.)

Map symbol and soil name	Spring wheat	Oats	Barley	Flax	Sunflowers	Grass-legume hay *
	Bu/A	Bu/A	Bu/A	Bu/A	Lbs/A	T/A
2049:	36	75	58	18	1780	2.3
Wyndmere--------						
2091:	12	27	20	6	620	1.3
Zell------------						
2206:	23	49	37	12	1150	2.0
Barnes----------						
Sioux-----------						
2207:	45	96	73	23	2260	2.3
Bearden---------						
2208:	21	45	34	11	1060	1.5
Brantford-------						
Coe-------------						
2209:	10	21	16	5	500	1.1
Buse------------						
Barnes----------						
2210:	16	34	26	8	790	1.0
Cathay----------						
Larson----------						
2211:	41	88	67	21	2060	2.7
Eckman----------						
Gardena---------						
2212:	38	82	62	19	1920	2.1
Eckman----------						
Zell------------						
2213:	28	60	46	14	1420	2.1
Eckman----------						
Zell------------						
2214:	14	31	23	7	720	0.9
Exline----------						
2215:	38	82	62	19	1920	2.1
Fairdale--------						
2216:	45(42)	96(68)	73(68)	23(21)	2260(2090)	2.3(1.9)
Gwinner---------						
Peever----------						
Parnell---------						
2217:	36(30)	78(49)	59(49)	18(15)	1820(1510)	2.1(1.6)
Hamerly---------						
Buse------------						
Parnell---------						
2218:	25	53	41	12	1250	2.1
Brantford-------						
Vang------------						

Table 8.—Yields per Acre of Crops--(continued)

(Yield estimates are those that can be expected under a high level of management. They are for nonirrigated areas. The presence of yield information does not indicate the soil is suited for cultivated crops. Absence of yield information indicates that the soil is not rated. Entries in () are for undrained conditions.)

Map symbol and soil name	Spring wheat	Oats	Barley	Flax	Sunflowers	Grass-legume hay *
	Bu/A	Bu/A	Bu/A	Bu/A	Lbs/A	T/A
2219:	42 (24)	90 (39)	69 (39)	21 (12)	2110 (1200)	2.3 (2.8)
Hegne-----------						
2220:	17	36	27	8	840	1.1
Letcher---------						
Lemert----------						
2221:	19	41	31	10	960	1.8
Falsen----------						
2222:	41	88	67	21	2060	2.2
Peever----------						
Gwinner---------						
2223:	20	43	33	10	1010	1.5
Renshaw---------						
Sioux-----------						
2224:	10 (7)	21 (11)	16 (11)	5 (3)	500 (340)	1.4 (1.4)
Serden----------						
Hamar-----------						
2225:	10	20	16	5	480	0.7
Sioux-----------						
2226:	12	27	20	6	620	1.3
Stirum----------						
Lemert----------						
2228:	14 (11)	31 (18)	23 (18)	7 (6)	720 (550)	1.7 (1.8)
Aylmer----------						
Rosewood--------						
Serden----------						

* Yield estimates are for adapted species.

Table 9.—Interpretive Groupings Report

(Dashes (—) indicate an interpretive group is not assigned. Entries in () are for undrained conditions.)

Soil name and map symbol	Pasture and hayland group	Land Capability Class	Windbreak suitability group
64:			
Arveson	Limy Subirrigated A5 (Wet C1)	2w (4w)	1K (2K)
76:			
Arvilla	Shallow to Gravel B1	3e	6G
86:			
Aylmer	Sands Soils H5	6e	10
Bantry	Sands Soils H5	6e	10
118:			
Barnes	Loamy and Silty A1	2e	3
Buse	Thin Upland A2	3e	8
120:			
Barnes	Loamy and Silty A1	3e	3
Buse	Thin Upland A2	4e	8
154:			
Barnes	Loamy and Silty A1	2c	3
Svea	Overflow and Run-on A3	2c	1
156:			
Barnes	Loamy and Silty A1	2e	3
Svea	Overflow and Run-on A3	2e	1
314:			
Buse	Thin Upland A2	6e	10
Barnes	Loamy and Silty A1	4e	3
450:			
Colvin	Limey Subirrigated A5 (Wet C1)	2w (4w)	1K (2K)
493:			
Darnen	Overflow and Run-on A3	2e	1
510:			
Divide	Limy Subirrigated A5	3s	1K
571:			
Embden	Sandy A6	3e	1
726:			
Fordville	Loamy and Silty A1	2s	6G
772:			
Gardena	Overflow and Run-on A3	2c	1
Eckman	Loamy and Silty A1	2c	3
794:			
Glyndon	Limy Subirrigated A5	2e	1K
795:			
Glyndon, saline	Saline G4	3s	9W
852:			
Hamar	Sands A7 (Wet C1)	4e (4w)	1(2)

Table 9.—Interpretive Groupings Report--(continued)

(Dashes (—) indicate an interpretive group is not assigned. Entries in () are for undrained conditions.)

Soil name and map symbol	Pasture and hayland group	Land Capability Class	Windbreak suitability group
883:			
Hamerly	Limy Subirrigated A5	2e	1K
Tonka	Clayey A4 (Wet C1)	2w (4w)	1(2)
Parnell	Wet C1 (Wetland H6)	3w (5w)	2(10)
939:			
Hecla	Sands A7	4e	7
Hamar	Sands A7	4e	1
1030:			
Kranzburg	Loamy and Silty A1	2e	3
Lismore	Overflow and Run-on A3	2e	1
1043:			
La Prairie	Loamy and Silty A1	2c	1
1055:			
LaDelle	Loamy and Silty A1	2c	1
1081:			
Lamoure	Limey Subirrigated A5 (Wet C1)	2w (4w)	1K(2K)
1168:			
Lismore	Overflow and Run-on A3	2c	1
Kranzburg	Loamy and Silty A1	2c	3
1205:			
Maddock	Sands A7	6e	10
1221:			
Maddock	Sands A7	4e	7
Hecla	Sands A7	4e	7
1269:			
Marysland	Limy Subirrigated A5 (Wet C1)	2w (4w)	1K(2K)
1403:			
Overly	Loamy and Silty A1	2c	1
1427:			
Parnell	Wet C1 (Wetland H6)	3w (5w)	2 (10)
1466:			
Pits, gravel and sand	—	8s	10
1472:			
Rauville	Wet C1 (Wetland H6)	3w (5w)	2K (10)
1523:			
Renshaw	Shallow to Gravel B1	3s	6G
1560:			
Rifle	Wet C1 (Wetland H6)	3w (5w)	2H

Table 9.--Interpretive Groupings Report--(continued)

(Dashes (--) indicate an interpretive group is not assigned. Entries in () are for undrained conditions.)

Soil name and map symbol	Pasture and hayland group	Land Capability Class	Windbreak suitability group
1577:			
Rosewood	Limy Subirrigated A5 (Wetland H6)	3w (4w)	1K (2K)
1648:			
Serden	Sands Soil H5	7e	10
Duneland	None Assigned (NA)	8e	10
1670:			
Ulen	Limy Subirrigated	3e	1K
Rosewood	Limy Subirrigated A5 (Wet C1)	3w (4w)	1K (2K)
1704:			
Sioux	Very Shallow to Gravel B2	6w	10
Renshaw	Shallow to Gravel B1	3e	6G
1709:			
Southam	Wet C1 (Wetland H6)	3w (8w)	2K(10)
1772:			
Svea	Loamy and Silty A1	2c	1
Gardena	Loamy and Silty A1	2c	1
1788:			
Swenoda	Overflow and Run-on A3	3e	1
Barnes	Loamy and Silty A1	2e	3
1834:			
Tonka	Clayey A4 (Wet C1)	2w (4w)	1(2)
1842:			
Towner	Sands A7	4e	7
1859:			
Ulen	Limy Subirrigated A5	3e	1K
1871:			
Vallers, saline	Saline G4	3s	9W
1883:			
Vallers	Limy Subirrigated A5 (Wet C1)	2w (3w)	1K (2K)
Parnell	Wet C1 (Wetland H6)	3w (5w)	2 (10)
1935:			
Venlo	Wet C1 (Wetland H6)	3w (5w)	2 (10)
1953:			
Wahpeton	Clayey A4	2e	4C
1978:			
Water	--	--	--
2049:			
Wyndmere	Limy Subirrigated A5	2e	1K

Table 9.—Interpretive Groupings Report--(continued)

(Dashes (—) indicate an interpretive group is not assigned. Entries in () are for undrained conditions.)

Soil name and map symbol	Pasture and hayland group	Land Capability Class	Windbreak suitability group
2091:			
Zell	Thin Uplands A2	7e	10
2206:			
Barnes	Loamy and Silty A1	3e	3
Sioux	Very Shallow to Gravel B2	6s	10
2207:			
Bearden	Limy Subirrigated A5	2e	1K
2208:			
Brantford	Shallow to Gravel B1	3e	6G
Coe	Very Shallow to Gravel B2	6s	10
2209:			
Buse	Steeply Sloping H3	7e	10
Barnes	Loamy and Silty A1	6e	10
2210:			
Cathay	Clayey Subsoils F1	6s	3
Larson	Claypan G1	6s	9L
2211:			
Eckman	Loamy and Silty A1	2e	3
Gardena	Overflow and Run-on A3	2e	1
2212:			
Eckman	Loamy and Silty A1	2e	3
Zell	Thin Upland A2	3e	8
2213:			
Eckman	Loamy and Silty A1	3e	3
Zell	Thin Upland A2	4e	8
2214:			
Exline	Thin Claypan G2	6s	10
2215:			
Fairdale	Loamy and Silty A1	2e	1K
2216:			
Gwinner	Overflow and Run-on A3	2c	1
Peever	Clayey A4	2s	4
Parnell	Wet C1 (Wetland H6)	3w (5w)	2 (10)
2217:			
Hamerly	Limy Subirrigated A5	2e	1K
Buse	Thin Uplands A2	3e	8
Parnell	Wet C1 (Wetland H6)	3w (5w)	2 (10)
2218:			
Brantford	Shallow to Gravel B1	3s	6G
Vang	Loamy and Silty A1	2s	6G
2219:			
Hegne	Clayey A4 (Wet C1)	2w (4w)	1K (2K)

Table 9.—Interpretive Groupings Report--(continued)

(Dashes (—) indicate an interpretive group is not assigned. Entries in () are for undrained conditions.)

Soil name and map symbol	Pasture and hayland group	Land Capability Class	Windbreak suitability group
2220:			
Letcher	Claypan G1	4s	9
Lemert	Thin Claypan G2	6s	9L
2221:			
Falsen	Sands A7	4e	7
2222:			
Peever	Clayey A4	2e	4
Gwinner	Overflow and Run-on A3	2e	1
2223:			
Renshaw	Shallow to Gravel B1	3e	6G
Sioux	Very Shallow to Gravel B2	6s	10
2224:			
Serden	Sands Soils H5	6e	10
Hamar	Sands A7 (Wet C1)	4e (4w)	1 (2)
2225:			
Sioux	Very Shallow to Gravel B2	6s	10
2226:			
Stirum	Sodic Saline G3	6s	10
Lemert	Thin Claypan G2	6s	9
2228:			
Aylmer	Sands Soils H5	6e	10
Rosewood	Limy Subirrigated A5 (Wet C1)	3w (4w)	1K (2K)
Serden	Sands Soils H5	6e	10

Table 10.—Windbreak Suitability Groups

Expected Shrub Heights at 20 Years

(Dashes (--) indicate the species are not expected to perform adequately on these suitability groups under most conditions.)

Species	Windbreak Suitability Groups					
	1	1K	2	2K	2H	3
	ft.	ft.	ft.	ft.	ft.	ft.
Almond, Russian	4-6	3-4	3-5	3-4	--	4-6
Buffaloberry, Silver	8-12	8-12	--	--	--	9-12
Caragana (Peashrub, Siberian)	8-10	8-10	7-8	--	--	8-10
Cherry, Europian Bird (Mayday)	10-15	--	10-15	--	--	10-12
Cherry, Nanking	6-8	--	4-6	--	--	5-7
Cherry, Mongolian	5-6	--	4-6	--	--	4-6
Cherry, Western Sand	4-6	--	--	--	--	4-6
Cotoneaster, Peking	8-10	7-9	8-10	--	--	7-9
Cotoneaster, Europian	10-12	9-11	8-12	--	--	7-9
Currant, Golden	5-7	--	4-6	--	--	5-6
Dogwood, Redosier	6-8	--	6-8	--	--	5-7
Forsythia, 'Meadowlark'	7-11	6-8	--	--	--	7-9
Honeysuckle, Amur	8-10	7-9	--	--	--	7-9
Honeysuckle, Blueleaf 'Freedom'	7-9	6-8	--	--	--	6-8
Honeysuckle, Tatarian	8-10	7-9	--	--	--	8-10
Indigo, False	7-9	6-8	7-9	7-9	--	5-7
Juneberry (Serviceberry)	6-8	--	5-7	--	--	5-7
Lilac, Common	10-12	10-12	8-10	8-10	--	8-10
Lilac, Late	10-12	8-10	10-12	8-10	--	8-10
Plum, American	7-9	--	6-7	--	--	7-9
Rose, Species	4-5	4-5	4-5	--	--	4-5
Sea-buckthorn	8-10	8-10	--	--	--	6-8
Silverberry	6-8	5-6	--	--	--	5-7
Sumac, Skunkbush	5-9	4-7	5-8	--	--	5-9
Willow, Sandbar	7-9	6-8	7-10	6-8	--	6-8
Viburnum, Nannyberry	12-16	--	12-14	--	--	10-12

Table 10.--Windbreak Suitability Groups--(continued)

Expected Shrub Heights at 20 Years

(Dashes (--) indicate the species are not expected to perform adequately on these suitability groups under most conditions.)

Species	Windbreak Suitability Groups					
	4	4C	5	6D	6G	7
	ft.	ft.	ft.	ft.	ft.	ft.
Almond, Russian	4-5	4-5	3-4	--	--	--
Buffaloberry, Silver	7-8	7-8	4-7	4-6	4-6	--
Caragana (Peashrub, Siberian)	7-8	5-6	7-9	6-8	6-8	--
Cherry, Europian Bird (Mayday)	10-12	8-10	8-10	6-8	4-6	--
Cherry, Nanking	4-5	4-5	4-5	--	--	--
Cherry, Mongolian	4-6	4-6	4-5	--	--	--
Cherry, Western Sand	--	--	4-6	3-5	3-5	--
Cotoneaster, Peking	6-7	5-7	6-7	--	--	--
Cotoneaster, Europian	9-10	8-9	8-10	--	--	--
Currant, Golden	3-5	3-5	5-6	--	--	--
Dogwood, Redosier	4-6	4-6	--	--	--	--
Forsythia, 'Meadowlark'	--	--	6-8	--	--	--
Honeysuckle, Amur	7-9	7-9	6-8	--	--	--
Honeysuckle, Blueleaf 'Freedom'	6-8	6-8	5-7	4-6	4-6	--
Honeysuckle, Tatarian	7-8	7-8	6-7	5-7	5-7	--
Indigo, False	--	--	--	--	--	--
Juneberry (Serviceberry)	5-6	5-6	--	--	--	--
Lilac, Common	6-8	5-7	7-9	5-7	5-7	--
Lilac, Late	7-9	7-9	--	--	--	--
Plum, American	6-8	6-8	5-7	--	--	--
Rose, Species	4-5	3-4	3-4	2-4	2-4	--
Sea-buckthorn	6-8	6-8	5-7	4-6	4-6	--
Silverberry	--	--	5-7	4-6	4-6	--
Sumac, Skunkbush	4-7	4-7	5-9	6-7	6-7	--
Willow, Sandbar	5-6	5-6	--	--	--	--
Viburnum, Nannyberry	--	--	8-10	--	--	--

Table 10.--Windbreak Suitability Groups--(continued)

Expected Shrub Heights at 20 Years

(Dashes (--) indicate the species are not expected to perform adequately on these suitability groups under most conditions.)

Species	Windbreak Suitability Groups				
	8	9C	9W	9L	10
	ft.	ft.	ft.	ft.	ft.
Almond, Russian	--	--	--	--	--
Buffaloberry, Silver	4-5	4-5	--	4-5	--
Caragana (Peashrub, Siberian)	4-5	4-5	--	4-5	6-8
Cherry, Europian Bird (Mayday)	--	--	--	--	4-6
Cherry, Nanking	--	--	--	--	--
Cherry, Mongolian	--	--	--	--	--
Cherry, Western Sand	--	--	--	--	3-5
Cotoneaster, Peking	--	--	--	--	--
Cotoneaster, Europian	--	--	--	--	--
Currant, Golden	--	3-4	3-4	3-4	--
Dogwood, Redosier	--	--	--	--	--
Forsythia, 'Meadowlark'	--	--	--	--	--
Honeysuckle, Amur	--	--	--	--	--
Honeysuckle, Blueleaf 'Freedom'	4-5	4-5	--	4-5	4-6
Honeysuckle, Tatarian	5-6	5-6	--	5-6	5-7
Indigo, False	--	--	--	--	--
Juneberry, (Serviceberry)	--	--	--	--	--
Lilac, Common	5-6	5-6	--	5-6	--
Lilac, Late	--	--	--	--	--
Plum, American	--	--	--	--	--
Rose, Species	--	--	--	--	2-4
Sea-buckthorn	4-5	4-5	--	4-5	4-6
Silverberry	3-5	3-5	--	3-5	4-6
Sumac, Skunkbush	3-4	3-4	--	3-4	6-7
Willow, Sandbar	--	--	--	--	--
Viburnum, Nannyberry	--	--	--	--	--

Table 10.--Windbreak Suitability Groups--(continued)

Expected Deciduous Tree Heights at 20 Years

(Dashes (--) indicate the species are not expected to perform adequately on these suitability groups under most conditions.)

Species	Windbreak Suitability Groups					
	1	1K	2	2K	2H	3
	ft.	ft.	ft.	ft.	ft.	ft.
Apricot, Species	16-20	15-18	--	--	--	15-17
Ash, Black	20-24	17-20	19-22	17-20	--	18-22
Ash, Green	21-26	19-24	21-26	19-24	--	20-25
Aspen, Quaking	27-32	22-27	27-32	22-27	--	--
Boxelder	20-25	--	16-20	--	--	19-24
Chokecherry, Common	11-14	9-12	9-11	7-9	--	10-12
Cottonwood, Species	45-50	40-45	43-48	35-40	--	--
Crabapple, Species	18-20	--	17-20	--	--	17-19
Elm, Japanese	29-35	24-30	--	--	--	29-35
Elm, Siberian	28-35	28-35	28-32	28-35	--	26-32
Hackberry, Common	20-25	18-23	20-25	18-23	--	20-25
Hawthorn, Arnold	10-12	8-10	9-11	6-8	--	9-11
Hawthorn, Downy	10-12	8-10	9-11	6-8	--	9-11
Honeylocust	20-25	18-20	20-25	--	--	18-20
Maple, Amur	12-14	--	9-11	--	--	11-12
Maple, Tatarian	12-14	--	9-11	--	--	11-12
Oak, Bur	20-25	18-23	--	--	--	18-20
Olive, Russian	15-19	15-19	15-19	15-19	--	15-19
Pear, Ussurian(Harbin)	16-18	--	14-16	--	--	16-18
Poplar, Hybrid Species	50-55	--	45-50	--	--	--
Poplar, White	33-40	33-35	33-35	33-35	--	25-30
Walnut, Black	22-28	--	--	--	--	17-21
Willow, Laurel	30-35	20-25	30-35	20-25	20-25	--
Willow, White	30-35	20-25	30-35	20-25	20-25	--

Table 10.--Windbreak Suitability Groups--(continued)

Expected Deciduous Tree Heights at 20 Years

(Dashes (--) indicate the species are not expected to perform adequately on these suitability groups under most conditions.)

Species	Windbreak Suitability Groups					
	4	4C	5	6D	6G	7
	ft.	ft.	ft.	ft.	ft.	ft.
Apricot, Species	--	--	--	--	--	--
Ash, Black	--	--	--	--	--	--
Ash, Green	18-20	18-20	15-19	14-18	14-18	--
Aspen, Quaking	--	--	--	--	--	--
Boxelder	--	--	--	--	--	--
Chokecherry, Common	8-10	7-9	8-10	7-9	7-9	--
Cottonwood, Species	--	--	--	--	--	--
Crabapple, Species	12-14	10-12	12-15	--	--	--
Elm, Japanese	26-30	26-30	26-30	19-22	19-22	--
Elm, Siberian	24-26	24-26	20-25	17-22	17-22	--
Hackberry, Common	16-18	16-18	15-18	--	--	--
Hawthorn, Arnold	7-9	7-9	8-10	6-8	6-8	--
Hawthorn, Downy	7-9	7-9	8-10	6-8	6-8	--
Honeylocust	--	--	15-18	--	--	--
Maple, Amur	--	--	--	--	--	--
Maple, Tatarian	--	--	--	--	--	--
Oak, Bur	14-16	13-15	18-20	--	--	--
Olive, Russian	12-14	12-14	12-15	11-14	11-14	--
Pear, Ussurian (Harbin)	11-13	11-13	11-13	--	--	--
Poplar, Hybrid Species	--	--	--	--	--	--
Poplar, White	--	--	--	--	--	--
Walnut, Black	--	--	--	--	--	--
Willow, Laurel	--	--	--	--	--	--
Willow, White	--	--	--	--	--	--

Table 10.—Windbreak Suitability Groups--(continued)

Expected Deciduous Tree Heights at 20 Years

(Dashes (--) indicate the species are not expected to perform adequately on these suitability groups under most conditions.)

Species	Windbreak Suitability Groups				
	8	9C	9W	9L	10
	ft.	ft.	ft.	ft.	ft.
Apricot, Species	--	--	--	--	--
Ash, Black	--	--	--	--	--
Ash, Green	12-16	9-11	9-10	9-13	--
Aspen, Quaking	--	--	--	--	--
Boxelder	--	--	--	--	--
Chokecherry, Common	--	--	--	--	--
Cottonwood, Species	--	--	--	--	--
Crabapple, Species	--	--	--	--	--
Elm, Japanese	19-21	11-15	--	11-15	--
Elm, Siberian	14-18	10-12	--	10-12	--
Hackberry, Common	--	--	--	--	--
Hawthorn, Arnold	--	--	--	--	--
Hawthorn, Downy	--	--	--	--	--
Honeylocust	--	--	--	--	--
Maple, Amur	--	--	--	--	--
Maple, Tatarian	--	--	--	--	--
Oak, Bur	--	--	--	--	--
Olive, Russian	11-14	6-8	6-8	8-10	--
Pear, Ussurian(Harbin)	--	8-9	--	--	--
Poplar, Hybrid Species	--	--	--	--	--
Poplar, White	--	--	--	--	--
Walnut, Black	--	--	--	--	--
Willow, Laurel	--	--	--	--	--
Willow, White	--	--	--	--	--

Table 10.—Windbreak Suitability Groups--(continued)

Expected Conifer Heights at 20 Years

(Dashes (--) indicate the species are not expected to perform adequately on these suitability groups under most conditions.)

Species	Windbreak Suitability Groups					
	1	1K	2	2K	2H	3
	ft.	ft.	ft.	ft.	ft.	ft.
Arborvitae, Siberian	12-15	10-12	12-15	10-13	--	8-11
Juniper, Rocky Mountain	12-15	10-12	11-13	8-9	--	12-15
Larch, Siberian	18-22	--	--	--	--	17-21
Pine, Ponderosa	18-22	15-17	17-19	--	--	18-22
Pine, Scotch	18-20	--	16-18	--	--	18-20
Redcedar, Eastern	12-15	10-12	11-13	8-9	--	12-15
Spruce, Black Hills	17-20	--	15-18	--	--	12-15
Spruce, Colorado Blue	17-20	--	15-18	--	--	15-19
Spruce, White	17-20	--	15-18	--	--	15-19

Table 10.— Windbreak Suitability Groups--(continued)

Expected Conifer Heights at 20 Years

(Dashes (--) indicate the species are not expected to perform adequately on these suitability groups under most conditions.)

Species	Windbreak Suitability Groups					
	4	4C	5	6D	6G	7
	ft.	ft.	ft.	ft.	ft.	ft.
Arborvitae, Siberian	7-10	7-10	--	--	--	--
Juniper, Rocky Mountain	10-12	10-12	11-13	9-11	9-11	7-9
Larch, Siberian	--	--	15-19	--	--	--
Pine, Ponderosa	16-17	16-17	16-20	11-16	11-16	11-15
Pine, Scotch	--	--	--	--	--	--
Redcedar, Eastern	10-12	10-12	11-13	9-11	9-11	8-10
Spruce, Black Hills	13-15	13-15	--	--	--	--
Spruce, Colorado Blue	13-15	13-15	--	--	--	--
Spruce, White	13-15	13-15	--	--	--	--

Table 10.--Windbreak Suitability Groups--(continued)

Expected Conifer Heights at 20 Years

(Dashes (--) indicate the species are not expected to perform adequately on these suitability groups under most conditions.)

Species	Windbreak Suitability Groups				
	8	9C	9W	9L	10
	ft.	ft.	ft.	ft.	ft.
Arborvitae, Siberian	--	--	--	--	--
Juniper, Rocky Mountain	6-8	6-7	5-6	6-7	--
Larch, Siberian	--	--	--	--	--
Pine, Ponderosa	11-15	8-10	--	8-10	--
Pine, Scotch	--	--	--	--	--
Redcedar, Eastern	7-9	6-7	5-6	6-7	--
Spruce, Black Hills	--	--	--	--	--
Spruce, Colorado Blue	--	--	--	--	--
Spruce, White	--	--	--	--	--

Rangeland

Rangeland makes up about 120,000 acres or 22 percent of the land in Ransom County. The majority of rangeland is on sandy plains associated with the Sheyenne River National Grasslands. Additional rangeland is found along the rolling to steep Sheyenne River Valley (fig. 14). The soils are generally unsuited to poorly suited for cultivated crops.

Rangeland is used primarily for grazing by domestic livestock; however, it also provides wildlife habitat, watershed protection, recreational areas, and aesthetic value.

Rangeland is defined as land on which the native vegetation (historic climax, or natural potential plant community) is predominantly grasses, grasslike plants, forbs, and shrubs. Rangeland includes natural grasslands, savannas, marshes and wet meadows. Cultural treatments, such as fertilization and cultivation, generally are not used or needed to maintain productivity of rangeland. The composition and production of the plant community are largely determined by soil, climate, topography, and grazing influences.

Range Sites

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil.

Soils vary in their capacity to produce grasses and other native plants. Soils that produce similar kinds, proportion, and amounts of vegetation are grouped into a range site.

Range Site is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. Over time, the combination of plants best suited to a particular soil and climate has become established. In the absence of excessive disturbances, this group of plants is the natural plant community or climax community for the site. Natural plant communities are not static but vary slightly from year to year and place to place. The natural potential plant community is generally, but not always, the most productive and diverse combination of plants that may occur on a site.

The relationship between soils and vegetation was determined during this survey. In most cases, range sites can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range sites. Soil reaction, salt content, and a seasonal high water table are also important. Many different range sites occur in the survey area. Range sites for each map unit component under undrained conditions are given in Table 11, "Range Sites."

The following paragraphs describe soil and landscape features and limitations associated with the range sites in Major Land Resource Areas (MLRAs) 55B and 56. The eastern one third of Ransom County is in MLRA 56; the remaining portion is in MLRA 55B. See the Index to Map Sheets that precedes the maps to determine the extent of each MLRA. Although range conditions and response to grazing are similar between the two MLRAs, MLRA 56 is considered to be tall grass prairie and range sites may have different composition than in MLRA 55B. Some of the range sites may not occur in Ransom County.

Clayey range site. These are very deep, well and moderately well drained, moderately fine and fine textured soils. Saturated hydraulic conductivity is slow or very slow. Available water capacity is high. This site is on nearly level to gently rolling glacial till plains, lake plains, and terraces of large streams. Slope ranges from 1 to 9 percent.

Site retrogression results in a decrease in the abundance of such plants as western wheatgrass, porcupinegrass, green needlegrass, and prairie junegrass. The plants that usually increase under these conditions are needleandthread, blue grama, fringed sagewort, and upland sedges. Further deterioration may result in a dominance of blue grama, upland sedges, western ragweed, and fringed sagewort, and invasion of Kentucky bluegrass.

Very few problems affect management of this site. The water infiltration rate is slow. As a result, an adequate cover of vegetation is needed to help reduce runoff.

Figure 14. Rangeland along the Sheyenne River.

Claypan range site. These are very deep, moderately well and well drained soils. They have moderately coarse to moderately fine textured surface layers underlain by a sodic subsoil. The subsoils are moderately coarse to fine textured and are high in sodium. Saturated hydraulic conductivity is very slow and available water capacity is moderate. This site is on nearly level to undulating glacial till plains and lake plains. Slope ranges from 0 to 6 percent.

Site retrogression generally results in a decrease in the abundance of such plants as green needlegrass, prairie junegrass, needleandthread, and western wheatgrass. The plants that tend to increase in abundance under retrogression include inland saltgrass, blue grama, Sandberg bluegrass, upland sedges, and fringed sagewort. Further deterioration results in a dominance of blue grama, inland saltgrass, upland sedges, fringed sagewort, broom snakeweed, and annual forbs.

This site is easily damaged by mismanagement. Because of a dense subsoil and the content of salts in the soil, reestablishing the vegetation is difficult in denuded areas. Management that maintains an abundance of the climax species will maintain production and protect the soil from erosion.

Limy Subirrigated range site. These are very deep soils that are typically somewhat poorly drained, but include some moderately well drained soils. They have a loamy fine sand to silty clay loam surface layer and typically have a water table at about 1.5 to 3.5 feet during the spring and early summer. These soils have a layer high in lime within 16 inches of the surface. This site is on level, nearly level, and gently sloping glacial lake plains, glacial till plains, and outwash plains. Slope ranges from 0 to 6 percent.

Site retrogression usually results in a decrease in the abundance of such plants as big bluestem, indiangrass, switchgrass, and Maximilian sunflower. Little bluestem usually increases initially in abundance under these conditions, but it eventually decreases with more severe deterioration. Further deterioration results in a dominance of Baltic rush, common

spikerush, annual grasses and forbs, and invasion of Kentucky bluegrass.

Generally, no major problems affect management. The dominant warm-season grasses on this site provide high-quality forage and wildlife habitat late in the growing season.

Overflow range site. These are very deep, moderately well and well drained, moderate to moderately fine textured soils that regularly receive additional run-on from surrounding uplands or flooding. Saturated hydraulic conductivity is moderate and available water capacity is high to very high. This site occurs in nearly level swales and depressions on glacial till plains and on stream terraces and flood plains. Slope ranges from 0 to 3 percent.

Site retrogression results in a decrease in the abundance of such plants as big bluestem, green needlegrass, prairie dropseed, and switchgrass. The plants that increase in abundance under these conditions are western wheatgrass, blue grama, sun sedge, and fescue sedge. Further deterioration results in a dominance of blue grama and sedges, and invasion of Kentucky bluegrass.

As a result of flooding and the upland runoff received by this site, it is very productive when properly managed.

Saline Lowland range site. These are very deep, somewhat poorly and poorly drained, medium and fine textured saline soils. Also included are some saline-sodic soils. This range site receives additional water from ground water seepage and/or run-on. Surface layers commonly are saline. Saturated hydraulic conductivity is moderate to very slow and available water capacity is moderate. This site occurs on shallow basins and lake plains and on low terraces and bottom lands along streams. Slope ranges from 0 to 3 percent.

Site retrogression results in a decrease in the abundance of such plants as Nuttall alkaligrass, slender wheatgrass, and western wheatgrass. The plants that increase in abundance under these conditions are inland saltgrass, alkali muhly, foxtail barley, and mat muhly. Further deterioration results in a dominance of inland saltgrass, foxtail barley, silverweed cinquefoil, and western dock.

A high content of salts and a moderate available water capacity limit production on this site. Proper management of the adapted salt-tolerant plants will maintain optimum production. If the plant community has been severely damaged, however, the site recovers slowly. Wind and water erosion are hazards in denuded areas. Stock water ponds on this site frequently contain salty water.

Sands range site. These are very deep, well or excessively drained, coarse textured soils. Saturated hydraulic conductivity is rapid and available water capacity is low to moderate. Soils on this site are highly susceptible to wind erosion. This site is on nearly level to steep outwash and delta plains. Slope ranges from 1 to 35 percent.

Site retrogression generally results in a decrease in the abundance of such plants as prairie sandreed, sand bluestem, and leadplant amorpha. The plants that increase in abundance under these conditions are sand dropseed, blue grama, needleandthread, upland sedges, and forbs. Further deterioration results in a dominance of blue grama, upland sedges, annual forbs, fringed sagewort, green sagewort, cudweed sagewort, and prairie rose.

The limited available water capacity and the hazard of wind erosion are concerns in managing this site. In severely disturbed areas, blowouts are common. The vegetation responds rapidly to improved management.

Sandy range site. These are very deep, well drained, moderately coarse textured soils. Saturated hydraulic conductivity is moderately rapid and available water capacity is moderate. These soils are friable and susceptible to wind erosion. This site is on nearly level to rolling glacial till plains, lake plains, and outwash plains. Slope ranges from 1 to 15 percent.

Site retrogression generally results in a decrease in the abundance of such plants as western wheatgrass, green needlegrass, prairie sandreed, and leadplant amorpha. The plants that increase under these conditions are needleandthread, blue grama, upland sedges, sand dropseed, and annual forbs. Further deterioration results in a dominance of blue grama, upland sedges, and forbs, such as western yarrow, green sagewort, and fringed sagewort.

Moderate available water capacity is a concern in managing this site. Also, wind erosion is a hazard in denuded areas. Management that maintains an abundance of the climax species results in a productive natural plant community and provides a good protective plant cover.

Sandy Claypan range site. These are very deep, somewhat poorly drained soils. They have moderately coarse textured surface layers underlain by a sodic subsoil. The subsoils are moderately coarse to medium textured and are high in sodium. Saturated hydraulic conductivity is very slow and available water capacity is low. This site is on nearly level outwash and lake plains. Slope ranges from 0 to 3 percent.

Site retrogression results in a decrease in the abundance of such plants as western wheatgrass and needleandthread. The plants that increase in abundance under these conditions are blue grama, upland sedges, and fringed sagewort. Further deterioration results in a dominance of blue grama,

upland sedges, fringed sagewort, annual forbs, and annual grasses.

The soils have a dense, sodic subsoil and a limited available water capacity. The site is fragile, and the natural plant community can deteriorate rapidly. Management that maintains a protective plant cover will control erosion.

Shallow to Gravel range site. These are shallow, moderately coarse and medium textured soils overlying sand and gravel at about 20 inches. They are somewhat excessively drained. Saturated hydraulic conductivity is moderate over moderately rapid and available water capacity is low. This site occurs on nearly level to steep outwash plains and stream terraces. Slope ranges from 1 to 25 percent.

Site retrogression results in a decrease in the abundance of such plants as green needlegrass, western wheatgrass, plains muhly, and prairie junegrass. The plants that increase in abundance under these conditions are blue grama, red threeawn, and upland sedges. Further deterioration results in a dominance of blue grama, upland sedges, annual forbs, and fringed sagewort.

Low available water capacity limits production on this site. The site is fragile, and the plant community can deteriorate rapidly. The plant community should be kept near its potential and maintained in a high state of vigor, in order to optimize use of available moisture.

Silty range site. These are moderately deep and very deep, well drained, medium and moderately fine textured soils. Saturated hydraulic conductivity is moderate and available water capacity is high or very high. This site is on nearly level to steep glacial till plains, lake plains, and on high stream terraces. Slope ranges from 1 to 25 percent.

Site retrogression generally results in a decrease in the abundance of such plants as green needlegrass, prairie junegrass, western wheatgrass, and porcupinegrass. The plants that increase in abundance under these conditions are needleandthread, blue grama, threadleaf sedge, needleleaf sedge, and fringed sagewort. Further deterioration results in a dominance of blue grama, threadleaf sedge, needleleaf sedge, fringed sagewort, and other forbs. Kentucky bluegrass often invades as conditions deteriorate.

Generally, no major problems affect management of this site. In the more sloping areas, however, gullies can form in denuded areas.

Subirrigated range site. These are very deep, somewhat poorly and poorly drained, moderately coarse to moderately fine textured soils. These soils have a high water table which keeps the rooting zone moist for most of the growing season. Saturated hydraulic conductivity is moderate to moderately slow and available water capacity is high. This site is on flats and in depressions and drainageways on glacial till plains, lake plains, and outwash plains. Slope ranges from 0 to 3 percent.

Site retrogression results in a decrease in the abundance of such plants as big bluestem, switchgrass, prairie cordgrass, northern reedgrass, indiangrass, and little bluestem. The plants that increase in abundance under these conditions are mat muhly, fowl bluegrass, Baltic rush, common spikerush, and various forbs. Further deterioration results in a dominance of Kentucky bluegrass, other short grasses, grasslike plants, and forbs.

The high percentage of warm-season species on this site can provide high quality forage and wildlife habitat late in the growing season.

Subirrigated Sands range site. These are very deep, somewhat poorly drained, coarse textured soils. Saturated hydraulic conductivity of these soils is rapid and available water capacity is low. This site occurs on nearly level or undulating delta plains. Slope ranges from 0 to 6 percent.

Site retrogression results in a decrease in the abundance of such plants as big bluestem, switchgrass, porcupinegrass, and Maximilian sunflower. The plants that increase in abundance under these conditions are sedges, undesirable forbs, and quaking aspen. Kentucky bluegrass is a common invader on this site. When the canopy of quaking aspen approaches 100 percent, the understory is dominated by sedges and shrubs.

The high percentage of warm-season species on this site can provide high-quality forage and wildlife habitat late in the growing season. The combination of grasses, sedges, forbs, shrubs, and trees provides a diversity of wildlife habitat and lends variety and fall color to the landscape. Because of the wide variation in canopy cover, individual areas of this site may vary widely. Wind erosion is a concern. It can be controlled by maintaining or reestablishing the climax grasses.

Thin Claypan range site. These are very deep, somewhat poorly to moderately well drained soils. The surface layer is thin, moderately coarse to moderately fine textured, and underlain by a dense sodic subsoil. The subsoils are moderately coarse to fine textured and high in sodium. Saturated hydraulic conductivity is very slow and available water capacity is low to moderate. This site is on nearly level to rolling glacial till plains and lake plains. Slope ranges from 0 to 9 percent.

Site retrogression usually results in a decrease in the abundance of such plants as western wheatgrass, prairie junegrass, and needleandthread. Plants that increase in abundance under these conditions are blue grama, inland saltgrass, Sandberg bluegrass, and alkali muhly. Further deterioration results in a dominance of short grasses, sedges, fringed sagewort, broom snakeweed, and other forbs.

Because of the dense subsoil and high content of subsoil salts, productivity is quite low on this site. Ponds constructed on this site are likely to be salty.

Thin Sands range site. These are very deep, excessively drained, coarse textured soils that have a thin surface horizon. Saturated hydraulic conductivity is rapid and available water capacity is low or very low. These soils are highly susceptible to wind erosion and require careful management. This site is on nearly level to very steep glacial outwash plains and wind-worked delta plains. Slope ranges from 1 to 50 percent.

Site retrogression results in a decrease in the abundance of such plants as prairie sandreed, prairie junegrass, little bluestem, sideoats grama, and sand bluestem. The plants that increase in abundance under these conditions are sand dropseed and upland sedges. Further deterioration results in a dominance of upland sedges, blue grama, and various forbs, and invasion of Kentucky bluegrass.

This site is very fragile. It is subject to wind erosion if the vegetation is damaged by overgrazing or the soil is denuded. Blowouts are common in disturbed areas. Proper management will maintain protective cover and optimum production.

Thin Upland range site. These very deep, well drained, medium and moderately fine textured soils have a thin surface horizon. Saturated hydraulic conductivity is moderately slow and available water capacity is high. This site is on gently sloping to very steep glacial till uplands. Slope ranges from 3 to 50 percent.

Site retrogression results in a decrease in the abundance of such plants as little bluestem, needleandthread, and sideoats grama. The plants that increase in abundance under these conditions are blue grama, red threeawn, upland sedges, and various forbs. Further deterioration results in a dominance of blue grama, upland sedges, and fringed sagewort.

Generally, no major problems affect management of this site. Wind and water erosion are a problem in denuded areas. In the more sloping areas, however, gullies can form along trails.

Very Shallow range site. These are very shallow soils over sand and gravel. They are moderately coarse to medium textured soils underlain by sand and gravel at about 10 inches. They are excessively drained. Saturated hydraulic conductivity is rapid and available water capacity is very low. This site is on nearly level to steep outwash plains and terraces. Slopes range from 1 to 35 percent.

Site retrogression results in a decrease in the abundance of such plants as needleandthread, western wheatgrass, and plains muhly. The plants that increase in abundance under these conditions are blue grama, red threeawn, sand dropseed, and upland sedges. Further deterioration results in a dominance of blue grama, red threeawn, upland sedges, and various forbs and shrubs.

Available water capacity is very low on this site. Water erosion is a hazard in the more sloping areas. Gullies can form along trails and in denuded areas. Productivity can be maintained by proper management of the dominant mid-grasses.

Wet Meadow range site. These are very deep, poorly drained, medium and fine textured soils that are briefly flooded in the spring and summer. The soils dry at the surface by mid-summer but have water in the root zone. This site occurs in swales and depressions on glacial till plains, glacial lake plains, and outwash channels. The site normally receives additional water from surface runoff and/or underground seepage. Slopes are 0 to 3 percent.

Site retrogression results in a decrease in the abundance of slim sedge, wooly sedge, northern reedgrass, prairie cordgrass, and switchgrass. The plants that increase in abundance under these conditions are fescue sedge, common spikerush, Baltic rush, mat muhly, and fowl bluegrass. Further deterioration results in a dominance of low-growing sedges, short grasses, western dock, and Canada thistle.

This site is easily damaged when it is wet. Grazing during wet periods results in compaction, trampling, and root shearing. The site also is an excellent source of high quality prairie hay.

Wetland range site. These are very deep, very poorly drained soils. Soil texture has little affect as to the kind of vegetation on the site. Water stands over the surface for a major part of the growing season. Saturated hydraulic conductivity of these soils is slow and available water capacity is high. This site is in depressions on glacial till plains, lake basins, and outwash channels. This site normally receives additional amounts of water from surface run-on and/or underground seepage. Slope is commonly less than 1 percent.

Site retrogression results in a decrease in the

abundance of such plants as rivergrass, slough sedge, prairie cordgrass, and northern reedgrass. The plants that increase in abundance under these conditions are slim sedge, Baltic rush, common spikesedge, and American sloughgrass. Further deterioration results in a dominance of Baltic rush, common spikesedge, and Mexican dock.

This site is easily damaged when it is wet. Grazing during wet periods results in soil compaction, trampling, and root shearing. Climax vegetation and the important wetland wildlife values are maintained under proper management.

Range Site Plant Community, Composition, and Production

Characteristic vegetation, species composition, total annual production and stocking rates by condition class are shown in Table 12, "Range Site Descriptions" for Major Land Resource Areas (MLRA) 55B and 56. See the Index to Map Sheets at the back of the publication to determine the extent of each MLRA.

The **characteristic vegetation** consists of grasses, grasslikes, forbs, shrubs, and trees that dominate the natural potential plant community on each range site. The plant species within these groups are listed by **common name**. Under **composition by weight,** the expected percentage of the total annual production is given for each major species and groups of minor species making up the characteristic vegetation.

The range site description helps interpret the ecological and utilitarian values of a given site, including grazing, wildlife habitat, watershed protection, recreation, and others.

Total annual production is the amount of vegetation that can be expected to grow annually on well managed rangeland, supporting the potential natural plant community. It includes all vegetation, whether or not palatable to grazing animals. It includes the current year's herbaceous growth, as well as growth of leaves, twigs, and fruit of woody plants. It does not include the increase in stem diameter of trees and shrubs. Potential production depends on the kind of range site. Current production depends on the rangeland condition and the amount of moisture available to the plants during the growing season. Production is expressed in pounds per acre of air-dry herbage for **favorable, average,** and **unfavorable** years, as determined by the amount and distribution of precipitation and the temperatures favorable to growing conditions.

Stocking Rates are based on production and expressed as **animal-unit months** per acre for **excellent, good, fair,** and **poor** range condition classes. Animal-Unit Month (AUM) is the amount of forage required monthly by an animal unit, generally described as one mature cow and one calf up to 6 months old.

Range Condition

Range condition indicates the present composition of the plant community on a range site in relation to the climax vegetation. Range condition is determined by comparing the present plant community with the natural potential plant community on a particular range site. The more closely the existing community resembles the potential community, the higher the range condition. Range condition is an ecological rating only, not a forage value rating. Range condition is expressed as **excellent, good, fair**, or **poor**, depending on how closely the present plant community resembles the natural potential plant community. **Excellent** indicates that 76 to 100 percent of the present plant community is the same as the climax vegetation; **good**, 51 to 75 percent; **fair**, 26 to 50 percent; and **poor**, 25 percent or less.

In some cases the plant community found on a site may not look similar to the potential plant community described in Table 12. This is usually due to a lower condition class, reflecting past disturbances, or in some cases long-term exclusion from grazing or fire. Abnormal disturbances that change the natural plant community include prolonged overgrazing or season-long grazing, excessive or untimely burning, erosion, and plowing. Under these circumstances, some of the climax plants decrease in proportion while others increase. Also, plants which were not part of the original native plant community may invade the site. A very severe disturbance, such as plowing, can completely destroy the natural plant community, resulting in dominance of annuals or weedy perennials of a lower plant successional status. If the plant community has not deteriorated significantly, it eventually can return to a higher condition class under proper range management.

Range Management

Range management requires a knowledge of the kinds of soils and of the potential natural plant community. It also requires an evaluation of the present range condition and trend. The primary objective in range management is to manipulate grazing in such a manner that the plants growing on a site are similar in kind and amount to the potential

natural plant community for that site. Such management generally results in the optimum production and diversity of vegetation, suppression of undesirable brush and weeds, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets forage needs, provides wildlife habitat, and protects soil and water resources.

Ecologically sound range management maintains excellent or good range condition. Water is conserved, yields are optimized, and soils are protected. An important management concern is recognizing the changes in the plant community that take place gradually and that can be misinterpreted or overlooked. Growth encouraged by heavy rainfall, for example, may lead to the conclusion that the range is in good condition when actually the plant cover is weedy and the long-term trend is toward lower production. On the other hand, some rangeland that has been grazed closely for a short period may have a degraded appearance that temporarily obscures its quality and ability to recover rapidly.

Rangeland can recover from prolonged overgrazing or other disturbance, if the climax species have not been completely eliminated from the plant community. Generally an adequate population of climax plants remains to restore the rangeland to excellent condition through sound grazing management. In areas where the climax plant community has been severely disturbed or destroyed, range seeding can accelerate improvement in range condition. Seeding the proper climax species also can restore productive rangeland on areas of depleted or low quality cropland or pastureland. Brush suppression, water developments, fencing, and other mechanical practices may be needed to facilitate proper grazing management for range improvement on some rangeland. Proper grazing management is the key to maintaining or improving the productivity and diversity of rangeland.

For additional information about rangeland management, contact the local Natural Resources Conservation Service or Cooperative Extension Service office.

Table 11.—Range Site Report

(Dashes (—) indicate an range site is not assigned. Range sites are for undrained conditions.)

Map Symbol and soil name	Range Site
64:	
Arveson	Wet Meadow
76:	
Arvilla	Shallow to Gravel
86:	
Aylmer	Sands
Bantry	Subirrigated Sands
118:	
Barnes	Silty
Buse	Thin Upland
120:	
Barnes	Silty
Buse	Thin Upland
154:	
Barnes	Silty
Svea	Overflow
156:	
Barnes	Silty
Svea	Overflow
314:	
Buse	Thin Upland
Barnes	Silty
450:	
Colvin	Wet Meadow
493:	
Darnen	Overflow
510:	
Divide	Limy Subirrigated
571:	
Embden	Sandy
726:	
Fordville	Silty
772:	
Gardena	Overflow
Eckman	Silty
794:	
Glyndon	Limy Subirrigated

Table 11.--Range Site Report--(continued)

(Dashes (--) indicate an range site is not assigned. Range sites are for undrained conditions.)

Map Symbol and soil name	Range Site
795:	
Glyndon, saline	Saline Lowland
852:	
Hamar	Subirrigated
883:	
Hamerly	Limy Subirrigated
Tonka	Wet Meadow
Parnell	Wetland
939:	
Hecla	Sands
Hamar	Subirrigated
1030:	
Kranzburg	Silty
Lismore	Overflow
1043:	
La Prairie	Silty
1055:	
LaDelle	Silty
1081:	
Lamoure	Wet Meadow
1168:	
Lismore	Overflow
Kranzburg	Silty
1205:	
Maddock	Sands
1221:	
Maddock	Sands
Hecla	Sands
1269:	
Marysland	Wet Meadow
1403:	
Overly	Silty
1427:	
Parnell	Wetland
1466:	
Pits, gravel and sand	--

Table 11.—Range Site Report--(continued)

(Dashes (—) indicate an range site is not assigned. Range sites are for undrained conditions.)

Map Symbol and soil name	Range Site
1472:	
Rauville	Wetland
1523:	
Renshaw	Shallow to Gravel
1560:	
Rifle	—
1577:	
Rosewood	Wet Meadow
1648:	
Serden	Thin Sands
Duneland	None Assigned
1670:	
Ulen	Limy Subirrigated
Rosewood	Wet Meadow
1704:	
Sioux	Very Shallow
Renshaw	Shallow to Gravel
1709:	
Southam	—
1772:	
Svea	Silty
Gardena	Silty
1788:	
Swenoda	Overflow
Barnes	Silty
1834:	
Tonka	Wet Meadow
1842:	
Towner	Sands
1859:	
Ulen	Limy Subirrigated
1871:	
Vallers, saline	Saline Lowland
1883:	
Vallers	Wet Meadow
Parnell	Wetland
1935:	
Venlo	Wetland

Table 11.—Range Site Report--(continued)

(Dashes (—) indicate an range site is not assigned. Range sites are for undrained conditions.)

Map Symbol and soil name	Range Site
1953:	
Wahpeton	Clayey
1978:	
Water	—
2049:	
Wyndmere	Limy Subirrigated
2091:	
Zell	Thin Upland
2206:	
Barnes	Silty
Sioux	Very Shallow
2207:	
Bearden	Limy Subirrigated
2208:	
Brantford	Shallow to Gravel
Coe	Very Shallow
2209:	
Buse	Thin Upland
Barnes	Silty
2210:	
Cathay	Silty
Larson	Claypan
2211:	
Eckman	Silty
Gardena	Overflow
2212:	
Eckman	Silty
Zell	Thin Upland
2213:	
Eckman	Silty
Zell	Thin Upland
2214:	
Exline	Thin Claypan
2215:	
Fairdale	Silty

Table 11.—Range Site Report--(continued)

(Dashes (—) indicate an range site is not assigned. Range sites are for undrained conditions.)

Map Symbol and soil name	Range Site
2216:	
Gwinner	Overflow
Peever	Clayey
Parnell	Wetland
2217:	
Hamerly	Limy Subirrigated
Buse	Thin Upland
Parnell	Wetland
2218:	
Brantford	Shallow to Gravel
Vang	Silty
2219:	
Hegne	Wet Meadow
2220:	
Letcher	Sandy Claypan
Lemert	Thin Claypan
2221:	
Falsen	Sands
2222:	
Peever	Clayey
Gwinner	Overflow
2223:	
Renshaw	Shallow to Gravel
Sioux	Very Shallow
2224:	
Serden	Thin Sands
Hamar	Subirrigated
2225:	
Sioux	Very Shallow
2226:	
Stirum	Subirrigated
Lemert	Thin Claypan
2228:	
Aylmer	Sands
Rosewood	Wet Meadow
Serden	Thin Sands

Table 12.— Range Site Descriptions (MLRA 55B)

Clayey Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Green Needlegrass		20
	Western Wheatgrass		35
	Other Perennial Grasses		10
	Bearded Wheatgrass		5
	Porcupinegrass		5
	Blue Grama		5
	Needleandthread	*	
	Plains Reedgrass	*	10
	Prairie Dropseed	*	
	Prairie Junegrass	*	
	Needleleaf Sedge	*	
	Penn Sedge	*	Trace
	Other Sedges/Rushes	*	
Forbs (5% to 15% of Total)	Cudweed Sagewort	*	
	Fringed Sagewort	*	
	Goatsbeard	*	
	Prairie Coneflower	*	10
	Scarlet Globemallow	*	
	Silverleaf Scurfpea	*	
	Western Yarrow	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Prairie Rose	*	
	Western Snowberry	*	5
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	2600 to 2900
Average	2250 to 2550
Unfavorable	1900 to 2200

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.75 to 1.00
Good	0.50 to 0.75
Fair	0.25 to 0.50
Poor	0.10 to 0.25

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 55B) -- (continued)

Claypan Range Site

Plant Community			
Characteristic Vegetation	Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Western Wheatgrass		25
	Blue Grama		15
	Green Needlegrass		10
	Needleandthread		10
	Prairie Junegrass		5
	Bearded Wheatgrass		5
	Inland Saltgrass	*	
	Porcupinegrass	*	5
	Tumblegrass	*	
	Other Perennial Grasses	*	
	Needleleaf Sedge	*	
	Penn Sedge	*	10
	Other Sedges/Rushes	*	
Forbs (5% to 15% of Total)	Fringed Sagewort	*	
	Mousear Chickweed	*	
	Rush Skeletonplant	*	
	Scarlet Globemallow	*	10
	Silverleaf Scurfpea	*	
	Western Yarrow	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Broom Snakeweed	*	
	Prairie Rose	*	5
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	2000 to 2250
Average	1700 to 1950
Unfavorable	1450 to 1650

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.53 to 0.70
Good	0.35 to 0.53
Fair	0.18 to 0.35
Poor	0.10 to 0.18

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 55B)--(continued)

Limy Subirrigated Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Little Bluestem		45
	Big Bluestem		15
	Indiangrass	*	10
	Switchgrass	*	
	Green Needlegrass	*	
	Needleandthread	*	
	Slender Wheatgrass	*	10
	Western Wheatgrass	*	
	Other Perennial Grasses	*	
	Rushes	*	10
	Sedge Species	*	
Forbs (5% to 15% of Total)	American Licorice	*	
	Goldenrod Species	*	
	Maximilian Sunflower	*	10
	Stiff Sunflower	*	
	Other Perennial Forbs	*	
Shrubs and Trees (0% of Total)			

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	4300 to 4800
Average	3700 to 4200
Unfavorable	3100 to 3600

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	1.20 to 1.60
Good	0.80 to 1.20
Fair	0.40 to 0.80
Poor	0.10 to 0.40

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 55B)--(continued)

Overflow Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Big Bluestem		30
	Bearded Wheatgrass		5
	Green Needlegrass		5
	Porcupinegrass		5
	Prairie Cordgrass		5
	Prairie Dropseed		5
	Switchgrass		5
	Western Wheatgrass		5
	Canada Wildrye	*	
	Needleandthread	*	5
	Northern Reedgrass	*	
	Indiangrass	*	
	Mat Muhly	*	5
	Tall Dropseed	*	
	Blue Grama	*	5
	Other Perennial Grasses	*	
	Fescue Sedge	*	
	Penn Sedge	*	5
	Other Sedges/Rushes	*	
Forbs (5% to 15% of Total)	Cudweed Sagewort	*	
	Fringed Sagewort	*	
	Heath Aster	*	
	Maximilian Sunflower	*	
	Silverleaf Scurfpea	*	10
	Wild Blue Lettuce	*	
	Wooly Goldenrod	*	
	Other Sedges/Rushes	*	
Shrubs and Trees (5% to 15% of Total)			

Total Annual Production Climatic Condition	(Excellent Condition) Pounds Per Acre (dry)
Favorable	3600 to 4000
Average	3175 to 3575
Unfavorable	2750 to 3150

Stocking Rates: Condition Class	**AUM Per Acre Per Year
Excellent	1.05 to 1.40
Good	0.70 to 1.05
Fair	0.35 to 0.70
Poor	0.10 to 0.35

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 55B)--(continued)

Saline Lowland Range Site

Plant Community			
Characteristic Vegetation	Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Western Wheatgrass		45
	Slender Wheatgrass		15
	Inland Saltgrass		10
	Nuttall Alkaligrass		5
	Alkali Cordgrass	*	
	Foxtail Cordgrass	*	
	Mat Muhly	*	10
	Plains Bluegrass	*	
	Other Perennial Grasses	*	
	Prairie Bulrush	*	5
	Other Sedges/Rushes	*	
Forbs (5% to 15% of Total)	Alkali Plantain	*	
	Silverweed	*	10
	Western Dock	*	
	Other Perennial Forbs	*	
Shrubs and Trees (0% of Total)			

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	3200 to 3500
Average	2850 to 3150
Unfavorable	2500 to 2800

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.90 to 1.20
Good	0.60 to 0.90
Fair	0.30 to 0.60
Poor	0.10 to 0.30

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 55B) -- (continued)

Sands Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Prairie Sandreed		25
	Needleandthread		10
	Blue Grama		5
	Porcupinegrass		5
	Sand Bluestem		5
	Western Wheatgrass		5
	Bearded Wheatgrass	*	
	Canada Wildrye	*	15
	Little Bluestem	*	
	Sand Dropseed	*	
	Green Needlegrass	*	
	Prairie Junegrass	*	10
	Other Perennial Grasses	*	
	Penn Sedge	*	
	Threadleaf Sedge	*	10
	Other Sedges/Rushes	*	
Forbs (5% to 15% of Total)	Fringed Sagewort	*	
	Green Sagewort	*	
	Hairy Goldaster	*	
	Purple Coneflower	*	15
	Purple Prairieclover	*	
	Stiff Goldenrod	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Leadplant Amorpha	*	
	Prairie Rose	*	5
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	2950 to 3300
Average	2575 to 2925
Unfavorable	2200 to 2550

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.83 to 1.10
Good	0.55 to 0.83
Fair	0.28 to 0.55
Poor	0.10 to 0.28

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 55B)--(continued)

Sandy Range Site

Plant Community			
Characteristic Vegetation	Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Prairie Sandreed		25
	Needleandthread		15
	Blue Grama		5
	Green Needlegrass		5
	Porcupinegrass		5
	Western Wheatgrass		5
	Bearded Wheatgrass	*	
	Prairie Dropseed	*	
	Prairie Junegrass	*	10
	Little Bluestem	*	
	Sand Dropseed	*	
	Other Perennial Grasses	*	
	Penn Sedge	*	
	Threadleaf Sedge	*	10
	Other Sedges/Rushes	*	
Forbs (5% to 15% of Total)	Cudweed Sagewort	*	
	Fringed Sagewort	*	
	Goatsbeard	*	
	Green Sagewort	*	
	Heath Aster	*	15
	Western Ragweed	*	
	Western Yarrow	*	
	Wooly Goldenrod	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Leadplant Amorpha	*	
	Prairie Rose	*	5
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	2850 to 3200
Average	2475 to 2825
Unfavorable	2100 to 2450

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.83 to 1.10
Good	0.55 to 0.83
Fair	0.28 to 0.55
Poor	0.10 to 0.28

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 55B)--(continued)

Sandy Claypan Range Site

Plant Community			
Characteristic Vegetation	Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Western Wheatgrass		35
	Needleandthread		20
	Blue Grama		15
	Green Needlegrass		5
	Prairie Junegrass		5
	Inland Saltgrass		5
	Other Perennial Grasses		5
	Sun Sedge	*	5
	Threadleaf Sedge	*	
Forbs (5% to 15% of Total)	Fringed Sagewort	*	
	Rush Skeletonplant	*	
	Scarlet Globemallow	*	5
	Other Perennial Forbs	*	
Shrubs and Trees (0% to 5% of Total)			Trace

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	2700 to 3200
Average	1800 to 2300
Unfavorable	800 to 1500

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.60 to 0.80
Good	0.40 to 0.60
Fair	0.20 to 0.40
Poor	0.10 to 0.20

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 55B)--(continued)

Shallow to Gravel Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Needleandthread		25
	Western Wheatgrass		20
	Blue Grama		10
	Green Needlegrass		10
	Bearded Wheatgrass		5
	Plains Muhly	*	
	Porcupinegrass	*	5
	Prairie Junegrass	*	
	Red Threeawn	*	
	Other Perennial Grasses	*	
	Penn Sedge	*	
	Threadleaf Sedge	*	10
	Other Sedges/Rushes	*	
Forbs (5% to 15% of Total)	Dotted Gayfeather	*	
	Fringed Sagewort	*	
	Hoods Phlox	*	
	Rush Skeletonplant	*	10
	Scarlet Globemallow	*	
	Wooly Goldenrod	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Prairie Rose	*	
	Western Snowberry	*	5
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	1900 to 2100
Average	1650 to 1850
Unfavorable	1400 to 1600

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.53 to 0.70
Good	0.35 to 0.53
Fair	0.18 to 0.35
Poor	0.10 to 0.18

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 55B)--(continued)

Silty Range Site

Plant Community			
Characteristic Vegetation	Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Western Wheatgrass		20
	Green Needlegrass		10
	Needleandthread		10
	Other Perennial Grasses		10
	Blue Grama		5
	Porcupinegrass		5
	Bearded Wheatgrass		5
	Big Bluestem	*	
	Prairie Dropseed	*	5
	Prairie Junegrass	*	
	Sideoats Grama	*	
	Needleleaf Sedge	*	
	Penn Sedge	*	10
	Other Sedges/Rushes	*	
Forbs (5% to 15% of Total)	Cudweed Sagewort	*	
	Dotted Gayfeather	*	
	Fringed Sagewort	*	
	Heath Aster	*	15
	Silverleaf Scurfpea	*	
	Stiff Sunflower	*	
	Western Yarrow	*	
	Wooly Goldenrod	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Prairie Rose	*	
	Western Snowberry	*	5
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	2800 to 3150
Average	2400 to 2750
Unfavorable	2000 to 2350

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.83 to 1.10
Good	0.55 to 0.83
Fair	0.28 to 0.55
Poor	0.10 to 0.28

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 55B) --(continued)

Subirrigated Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Big Bluestem		40
	Switchgrass		20
	Prairie Cordgrass		5
	Little Bluestem		5
	Indiangrass	*	
	Northern Reedgrass	*	5
	Slender Wheatgrass	*	
	Western Wheatgrass	*	
	Canada Wildrye	*	
	Tall Dropseed	*	5
	Other Perennial Grasses	*	
	Fescue Sedge	*	
	Slim Sedge	*	5
	Wooly Sedge	*	
	Baltic Rush	*	
	Common Spikerush	*	5
	Other Sedges/Rushes	*	
Forbs (5% to 15% of Total)	Cinquefoil	*	
	Field Mint	*	
	Heath Aster	*	
	Maximilian Sunflower	*	10
	Tall Goldenrod	*	
	Tall White Aster	*	
	Other Sedges/Rushes	*	
Shrubs and Trees (0% of Total)			

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	4350 to 4750
Average	3925 to 4325
Unfavorable	3500 to 3900

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	1.28 to 1.70
Good	0.85 to 1.28
Fair	0.43 to 0.85
Poor	0.10 to 0.43

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 55B)--(continued)

Subirrigated Sands Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Switchgrass		20
	Big Bluestem		15
	Porcupinegrass		5
	Prairie Cordgrass		5
	Bluejoint Reedgrass	*	
	Mat Muhly	*	5
	Other Perennial Grasses	*	
	Sedge Species	*	25
	Other Sedges/Rushes	*	
Forbs (5% to 15% of Total)	Maximilian Sunflower	*	
	Cudweed Sagewort	*	10
	Western Ragweed	*	
Shrubs and Trees (5% to 15% of Total)	Western Snowberry	*	
	Willow Species	*	10
	Spirea	*	
	Prairie Rose	*	
	Quaking Aspen		5

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	3200 to 3700
Average	2600 to 3100
Unfavorable	2000 to 2500

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.83 to 1.10
Good	0.55 to 0.83
Fair	0.28 to 0.55
Poor	0.10 to 0.28

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 55B)--(continued)

Thin Claypan Range Site

Characteristic Vegetation	Common Name		Composition By Weight (percent)
	Plant Community		
Grasses and Grasslikes (70% to 90% of Total)	Western Wheatgrass		50
	Blue Grama		15
	Nuttall Alkaligrass		5
	Prairie Junegrass		5
	Alkali Muhly	*	
	Green Needlegrass	*	
	Inland Saltgrass	*	5
	Needleandthread	*	
	Sandberg Bluegrass	*	
	Other Perennial Grasses	*	
	Needleleaf Sedge	*	
	Penn Sedge	*	5
	Other Sedges/Rushes	*	
Forbs (5% to 15% of Total)	Bladderpod	*	
	Fringed Sagewort	*	
	Lemon Scurfpea	*	
	Rush Skeletonplant	*	10
	Scarlet Globemallow	*	
	Western Yarrow	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Broom Snakeweed	*	5
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	1200 to 1300
Average	1000 to 1100
Unfavorable	800 to 900

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.30 to 0.40
Good	0.20 to 0.30
Fair	0.10 to 0.20
Poor	0.05 to 0.10

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 55B)--(continued)

Thin Sands Range Site

Plant Community			
Characteristic Vegetation	Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Prairie Sandreed		25
	Little Bluestem		15
	Sideoats Grama		10
	Canada Wildrye		5
	Sand Bluestem		5
	Other Perennial Grasses		5
	Blue Grama	*	
	Green Needlegrass	*	
	Needleandthread	*	5
	Prairie Junegrass	*	
	Sand Dropseed	*	
	Western Wheatgrass	*	
	Needleleaf Sedge	*	10
	Penn Sedge	*	
	Other Sedges/Rushes	*	
Forbs (5% to 15% of Total)	Fringed Sagewort	*	
	Green Sagewort	*	
	Groundcherry	*	
	Hairy Goldaster	*	15
	Lemon Scurfpea	*	
	Missouri Golderod	*	
	Prairie Spiderwort	*	
	Rush Skeletonplant	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Leadplant Amorpha	*	
	Sand Cherry	*	10
	Woods Rose	*	
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	2200 to 2400
Average	1900 to 2100
Unfavorable	1700 to 1800

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.60 to 0.80
Good	0.40 to 0.60
Fair	0.20 to 0.40
Poor	0.10 to 0.20

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 55B)--(continued)

Thin Upland Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Little Blustem		25
	Needleandthread		5
	Green Needlegrass		5
	Plains Muhly		5
	Porcupinegrass		5
	Prairie Dropseed		5
	Sideoats Grama		5
	Western Wheatgrass		5
	Other Perennial Grasses		5
	Blue Grama	*	
	Prairie Junegrass	*	Trace
	Prairie Sandreed	*	
	Red Threeawn	*	
	Penn Sedge	*	
	Threadleaf Sedge	*	10
	Other Sedges/Rushes	*	
Forbs (5% to 15% of Total)	Dotted Gayfeather	*	
	Fringed Sagewort	*	
	Missouri Golderod	*	
	Pasqueflower	*	10
	Purple Coneflower	*	
	Purple Prairieclover	*	
	Stiff Goldenrod	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Silverberry	*	
	Western Snowberry	*	5
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	2500 to 2800
Average	2150 to 2450
Unfavorable	1800 to 2100

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.68 to 0.90
Good	0.45 to 0.68
Fair	0.23 to 0.45
Poor	0.10 to 0.23

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 55B)--(continued)

Very Shallow Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Needleandthread		30
	Western Wheatgrass		10
	Blue Grama		10
	Bearded Wheatgrass		5
	Prairie Dropseed		5
	Prairie Junegrass		5
	Red Threeawn		5
	Plains Muhly	*	
	Red Threeawn	*	5
	Sand Dropseed	*	
	Other Perennial Grasses	*	
	Penn Sedge	*	
	Threadleaf Sedge	*	15
	Other Sedges/Rushes	*	
Forbs (5% to 15% of Total)	Dotted Gayfeather	*	
	Fringed Sagewort	*	
	Green Sagewort	*	
	Purple Prairieclover	*	10
	Rush Skeletonplant	*	
	Western Yarrow	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Broom Snakeweed	*	
	Prairie Rose	*	5
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	1100 to 1200
Average	900 to 1000
Unfavorable	800 to 900

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.30 to 0.40
Good	0.20 to 0.30
Fair	0.10 to 0.20
Poor	0.05 to 0.10

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 55B)--(continued)

Wet Meadow Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Northern Reedgrass		5
	Prairie Cordgrass		5
	Fowl Bluegrass	*	
	Mat Muhly	*	5
	Switchgrass	*	
	Other Perennial Grasses	*	
	Slim Sedge	*	70
	Wooly Sedge	*	
	Baltic Rush	*	
	Common Spikerush	*	5
	Fescue Sedge	*	
	Other Sedges/Rushes	*	
Forbs (5% to 15% of Total)	Field Mint	*	
	Indian Hemp	*	
	Rydberg's Sunflower	*	10
	Tall Goldenrod	*	
	Tall White Aster	*	
	Other Perennial Forbs	*	
Shrubs and Trees (0% of Total)			

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	4500 to 4800
Average	4100 to 4400
Unfavorable	3700 to 4000

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	1.35 to 1.80
Good	0.90 to 1.35
Fair	0.45 to 0.90
Poor	0.10 to 0.45

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 55B)--(continued)

Wetland Range Site

Plant Community			
Characteristic Vegetation	Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	American Mannagrass	*	
	American Sloughgrass	*	
	Northern Reedgrass	*	5
	Prairie Cordgrass	*	
	Other Perennial Grasses	*	5
	Baltic Rush	*	
	Burreed	*	5
	Common Spikerush	*	
	Other Sedged/Rushes	*	
	Beaked Sedge	*	
	Slough Sedge	*	50
	Smooth-Cone Sedge	*	
	Water Sedge	*	
	Slim Sedge	*	5
	Wooly Sedge	*	
Forbs (5% to 15% of Total)	Longroot Smartweed	*	
	Mexican Dock	*	
	Waterparsnip	*	5
	Waterplaintain	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Sandbar Willow	*	Trace
	Willow Species	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	6600 to 7000
Average	6100 to 6500
Unfavorable	5600 to 6000

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	1.95 to 2.60
Good	1.30 to 1.95
Fair	0.65 to 1.30
Poor	0.10 to 0.65

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 56)

Clayey Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Western Wheatgrass		30
	Green Needlegrass		20
	Bearded Wheatgrass		5
	Porcupinegrass		5
	Blue Grama		5
	Needleandthread	*	
	Plains Reedgrass	*	
	Prairie Dropseed	*	10
	Prairie Junegrass	*	
	Other Perennial Grasses		10
	Needleleaf Sedge	*	
	Threadleaf Sedge	*	Trace
	Other Upland Sedge	*	
Forbs (5% to 15% of Total)	Goatsbeard	*	
	Prairie Coneflower	*	
	Fringed Sagewort	*	10
	Scarlet Globemallow	*	
	Cudweed Sagewort	*	
	Silverleaf Scurfpea	*	
	Western Yarrow	*	
	Other Perennial Forbs	*	
Shrubs and Trees (1% to 5% of Total)	Prairie Rose	*	
	Western Snowberry	*	5
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	2600 to 2900
Average	2250 to 2550
Unfavorable	1900 to 2200

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.75 to 1.00
Good	0.50 to 0.75
Fair	0.25 to 0.50
Poor	0.10 to 0.25

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 56)--(continued)

Claypan Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Western Wheatgrass		25
	Blue Grama		15
	Green Needlegrass		10
	Needleandthread		10
	Porcupinegrass		5
	Prairie Junegrass		5
	Bearded Wheatgrass	*	
	Inland Saltgrass	*	5
	Other Perennial Grasses	*	
	Needleleaf Sedge	*	
	Penn Sedge	*	10
	Other Sedge/Rushes	*	
Forbs (5% to 15% of Total)	Fringed Sagewort	*	
	Scarlet Globemallow	*	
	Rush Skeletonplant	*	
	Silverleaf Scurfpea	*	5
	Western Yarrow	*	
	Wild Parsley	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Broom Snakeweed	*	
	Western Snowberry	*	10
	Wood Rose	*	
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	2000 to 2250
Average	1700 to 1950
Unfavorable	1400 to 1650

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.53 to 0.70
Good	0.35 to 0.53
Fair	0.18 to 0.35
Poor	0.10 to 0.18

*Indicates the composition for species group
**Animal units per month

Table 12.-- Range Site Descriptions (MLRA 56)--(continued)

Limy Subirrigated Range Site

Plant Community			
Characteristic Vegetation	Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Little Bluestem		45
	Big Bluestem		15
	Indiangrass	*	10
	Switchgrass	*	
	Western Wheatgrass	*	
	Green Needlegrass	*	
	Needleandthread	*	10
	Slender Wheatgrass	*	
	Other Perennial Grasses	*	
	Rushes	*	10
	Sedge Species	*	
Forbs (5% to 15% of Total)	American Licorice	*	
	Goldenrod Species	*	
	Maximilian Sunflower	*	10
	Stiff Sunflower	*	
	Other Perennial Forbs	*	
Shrubs and Trees (0% of Total)			

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	4300 to 4800
Average	3700 to 4200
Unfavorable	3100 to 3600

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	1.20 to 1.60
Good	0.80 to 1.20
Fair	0.40 to 0.80
Poor	0.10 to 0.40

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 56)--(continued)

Overflow Range Site

Characteristic Vegetation	Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Big Bluestem		25
	Indiangrass		10
	Switchgrass		10
	Green Needlegrass		5
	Porcupinegrass		5
	Prairie Cordgrass		5
	Prairie Dropseed		5
	Western Wheatgrass		5
	Canada Wildrye	*	
	Needleandthread	*	5
	Bearded Wheatgrass	*	
	Northern Reedgrass	*	
	Mat Muhly	*	
	Tall Dropseed	*	
	Sideoats Grama	*	5
	Blue Grama	*	
	Other Perennial Grasses	*	
	Fescue Sedge	*	
	Needleleaf Sedge	*	5
	Other Upland Sedges	*	
Forbs (5% to 15% of Total)	Heath Aster	*	
	Maximilian Sunflower	*	
	Wild Bluelettuce	*	10
	Wooly Goldenrod	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Western Snowberry	*	
	Common Chokecherry	*	5
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	4500 to 4800
Average	4100 to 4400
Unfavorable	3700 to 4000

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	1.35 to 1.80
Good	0.90 to 1.35
Fair	0.45 to 0.90
Poor	0.10 to 0.45

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 56)--(continued)

Saline Lowland Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Western Wheatgrass		40
	Slender Wheatgrass		15
	Nuttall Alkaligrass		10
	Inland Saltgrass		10
	Foxtail Barley		5
	Alkali Cordgrass	*	
	Alkali Muhly	*	
	Mat Muhly	*	10
	Plains Bluegrass	*	
	Other Perennial Grasses	*	
	Prairie Bulrush	*	Trace
	Other Sedge/Rushes	*	
Forbs (5% to 15% of Total)	Alkali Plantian	*	
	Dock Species	*	10
	Silver Cinquefoil	*	
	Other Perennial Forbs	*	
Shrubs and Trees (0% of Total)			

Total Annual Production Climatic Condition	(Excellent Condition) Pounds Per Acre (dry)
Favorable	3200 to 3500
Average	2850 to 3150
Unfavorable	2500 to 2800

Stocking Rates: Condition Class	**AUM Per Acre Per Year
Excellent	0.90 to 1.20
Good	0.60 to 0.90
Fair	0.30 to 0.60
Poor	0.10 to 0.30

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 56)--(continued)

Sands Range Site

Plant Community			
Characteristic Vegetation	Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Prairie Sandreed		25
	Needleandthread		15
	Porcupinegrass		5
	Sand Bluestem		5
	Western Wheatgrass		5
	Blue Grama		5
	Bearded Wheatgrass	*	
	Canada Wildrye	*	15
	Sand Dropseed	*	
	Green Needlegrass	*	
	Prairie Junegrass	*	10
	Other Perennial Grasses	*	
	Penn Sedge	*	
	Threadleaf Sedge	*	10
	Other Sedges/Rushes	*	
Forbs (5% to 15% of Total)	Fringed Sagewort	*	
	Green Sagewort	*	
	Hairy Goldaster	*	
	Purple Coneflower	*	10
	Purple Prairieclover	*	
	Stiff Goldenrod	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Leadplant Amorpha	*	
	Prairie Rose	*	5
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	2850 to 3200
Average	2475 to 2825
Unfavorable	2100 to 2450

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.83 to 1.10
Good	0.55 to 0.83
Fair	0.28 to 0.55
Poor	0.10 to 0.28

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 56)--(continued)

Sandy Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Prairie Sandreed		25
	Needleandthread		15
	Blue Grama		5
	Green Needlegrass		5
	Porcupinegrass		5
	Western Wheatgrass		5
	Bearded Wheatgrass	*	
	Prairie Dropseed	*	
	Prairie Junegrass	*	10
	Sand Dropseed	*	
	Other Perennial Grasses	*	
	Penn Sedge	*	
	Threadleaf Sedge	*	10
	Other Sedges/Rushes	*	
Forbs (5% to 15% of Total)	Cudweed Sagewort	*	
	Fringed Sagewort	*	
	Goatsbeard	*	
	Green Sagewort	*	15
	Heath Aster	*	
	Western Ragweed	*	
	Western Yarrow	*	
	Wooly Goldenrod	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Leadplant Amorpha	*	
	Prairie Rose	*	5
	Western Snowberry	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	2850 to 3200
Average	2475 to 2825
Unfavorable	2100 to 2450

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.83 to 1.10
Good	0.55 to 0.83
Fair	0.28 to 0.55
Poor	0.10 to 0.28

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 56)--(continued)

Sandy Claypan Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Western Wheatgrass		35
	Blue Grama		20
	Needleandthread		20
	Prairie Junegrass	*	5
	Other Perennial Grasses	*	
	Sun Sedge	*	5
	Threadleaf Sedge	*	
Forbs (5% to 15% of Total)	Fringed Sagewort	*	
	Rush Skeletonplant	*	5
	Scarlet Globemallow	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Silver Sagebrush	*	10
	Western Snowberry	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	3200 to 3700
Average	2600 to 3100
Unfavorable	2000 to 2500

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.83 to 1.10
Good	0.55 to 0.83
Fair	0.28 to 0.55
Poor	0.10 to 0.28

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 56)--(continued)

Shallow to Gravel Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Needleandthread		30
	Western Wheatgrass		15
	Blue Grama		10
	Green Needlegrass		10
	Porcupinegrass		5
	Prairie Junegrass		5
	Bearded Wheatgrass	*	
	Plains Muhly	*	5
	Red Threeawn	*	
	Other Perennial Grasses	*	
	Penn Sedge	*	
	Threadleaf Sedge	*	5
	Other Sedge/Rushes	*	
Forbs (5% to 15% of Total)	Dotted Gayfeather	*	
	Fringed Sagewort	*	
	Hoods Phlox	*	10
	Rush Skeletonplant	*	
	Scarlet Globemallow	*	
	Wooly Goldenrod	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Prairie Rose	*	
	Western Snowberry	*	5
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	1900 to 2100
Average	1650 to 1850
Unfavorable	1400 to 1600

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.53 to 0.70
Good	0.35 to 0.53
Fair	0.18 to 0.35
Poor	0.10 to 0.18

*Indicates the composition for species group

**Animal units per month

Table 12.— Range Site Descriptions (MLRA 56)--(continued)

Silty Range Site

Plant Community			
Characteristic Vegetation	Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Needleandthread		20
	Procupinegrass		15
	Green Needlegrass		15
	Western Wheatgrass		10
	Bearded Wheatgrass		5
	Blue Grama		5
	Big Bluestem	*	
	Prairie Dropseed	*	
	Other Perennial Grasses	*	5
	Prairie Junegrass	*	
	Needleleaf Sedge	*	
	Penn Sedge	*	5
	Other Sedge/Rushes	*	
Forbs (5% to 15% of Total)	Bastard Toadflax	*	
	Cottonweed	*	
	Fringed Sagewort	*	
	Heath Aster	*	10
	Cudweed Sagewort	*	
	Stiff Goldenrod	*	
	Western Yarrow	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Leadplant Amorpha	*	
	Silverberry	*	
	Western Snowberry	*	10
	Woods Rose	*	
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	2800 to 3150
Average	2400 to 2750
Unfavorable	2000 to 2350

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.83 to 1.10
Good	0.55 to 0.83
Fair	0.28 to 0.55
Poor	0.10 to 0.28

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 56)--(continued)

Subirrigated Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Big Bluestem		35
	Switchgrass		25
	Little Bluestem		5
	Prairie Cordgrass		5
	Indiangrass	*	
	Northern Reedgrass	*	5
	Slender Wheatgrass	*	
	Western Wheatgrass	*	
	Canada Wildrye	*	
	Tall Dropseed	*	5
	Other Perennial Grasses	*	
	Fescue Sedge	*	
	Slim Sedge	*	5
	Wooly Sedge	*	
	Baltic Rush	*	
	Common Spikerush	*	5
	Other Sedge/Rushes	*	
Forbs (5% to 15% of Total)	Field Mint	*	
	Heath Aster	*	
	Maximilian Sunflower	*	
	Cinquefoil	*	10
	Tall Goldenrod	*	
	Tall White Aster	*	
	Other Perennial Forbs	*	
Shrubs and Trees (0 % of Total)			

Total Annual Production Climatic Condition	(Excellent Condition) Pounds Per Acre (dry)
Favorable	4350 to 4750
Average	3925 to 4325
Unfavorable	3500 to 3900

Stocking Rates: Condition Class	**AUM Per Acre Per Year
Excellent	1.28 to 1.70
Good	0.85 to 1.28
Fair	0.43 to 0.85
Poor	0.10 to 0.43

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 56)--(continued)

Subirrigated Sands Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Switchgrass		20
	Big Bluestem		15
	Porcupinegrass		5
	Prairie Cordgrass		5
	Bluejoint Reedgrass	*	
	Mat Muhly	*	5
	Other Perennial Grasses	*	
	Sedge Species	*	25
	Other Sedges/Rushes	*	
Forbs (5% to 15% of Total)	Maximilian Sunflower	*	
	Cudweed Sagewort	*	10
	Western Ragweed	*	
Shrubs and Trees (5% to 15% of Total)	Western Snowberry	*	
	Willow Species	*	10
	Spirea	*	
	Prairie Rose	*	
	Quaking Aspen		5

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	3200 to 3700
Average	2600 to 3100
Unfavorable	2000 to 2500

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.83 to 1.10
Good	0.55 to 0.83
Fair	0.28 to 0.55
Poor	0.10 to 0.28

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 56)--(continued)

Thin Claypan Range Site

Plant Community			
Characteristic Vegetation	Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Western Wheatgrass		50
	Blue Grama		20
	Inland Saltgrass		5
	Prairie Junegrass		5
	Alkali Muhly	*	
	Needleandthread	*	
	Sandberg Bluegrass	*	Trace
	Thumble Grass	*	
	Other Perennial Grasses	*	
	Needleleaf Sedge	*	
	Penn Sedge	*	5
	Other Sedge/Rushes	*	
Forbs (5% to 15% of Total)	Bladderpod	*	
	Fringed Sagewort	*	
	Lemon Scurfpea	*	
	Rush Skeletonplant	*	10
	Scarlet Globemallow	*	
	Western Yarrow	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Broom Snakeweed	*	5
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	1200 to 1300
Average	1000 to 1100
Unfavorable	800 to 900

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.30 to 0.40
Good	0.20 to 0.30
Fair	0.10 to 0.20
Poor	0.05 to 0.10

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 56)--(continued)

Thin Sands Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Needleandthread		25
	Prairie Sandreed		25
	Blue Grama		5
	Prairie Junegrass		5
	Sand Bluestem		5
	Other Perennial Grasses		5
	Canada Wildrye	*	
	Green Needlegrass	*	
	Little Bluestem	*	5
	Sand Dropseed	*	
	Western Wheatgrass	*	
	Needleleaf Sedge	*	
	Penn Sedge	*	5
	Other Sedge/Rushes	*	
Forbs (5% to 15% of Total)	Fringed Sagewort	*	
	Groundcherry	*	
	Green Sagewort	*	
	Hairy Goldaster	*	10
	Lemon Scurfpea	*	
	Missouri Goldenrod	*	
	Rush Skeletonplant	*	
	Other Sedges/Rushes	*	
Shrubs and Trees (5% to 15% of Total)	Leadplant Amorpha	*	
	Sand Cherry	*	10
	Woods Rose	*	
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	2200 to 2400
Average	1900 to 2100
Unfavorable	1700 to 1800

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.60 to 0.80
Good	0.40 to 0.60
Fair	0.20 to 0.40
Poor	0.10 to 0.20

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 56)--(continued)

Thin Upland Range Site

Plant Community			
Characteristic Vegetation	Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Little Bluestem		25
	Needleandthread		10
	Green Needlegrass		5
	Bearded Wheatgrass		5
	Plains Muhly		5
	Porcupinegrass		5
	Prairie Dropseed		5
	Sideoats Grama		5
	Western Wheatgrass		5
	Other Perennial Grasses		5
	Blue Grama	*	
	Prairie Sandreed	*	
	Prairie Junegrass	*	Trace
	Red Threeawn	*	
	Penn Sedge	*	
	Threadleaf Sedge	*	10
	Other Sedge/Rushes	*	
Forbs (5% to 15% of Total)	Missouri Goldenrod	*	
	Pasqueflower	*	
	Fringed Sagewort	*	
	Dotted Gayfeather	*	10
	Black Sampson	*	
	Purple Prairieclover	*	
	Stiff Goldenrod	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Silverberry	*	
	Western Snowberry	*	5
	Other Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	2500 to 2800
Average	2150 to 2450
Unfavorable	1800 to 2100

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.68 to 0.90
Good	0.45 to 0.68
Fair	0.23 to 0.45
Poor	0.10 to 0.23

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 56)--(continued)

Very Shallow Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Needleandthread		35
	Blue Grama		10
	Western Wheatgrass		10
	Plains Muhly		5
	Prairie Junegrass		5
	Red Threeawn		5
	Bearded Wheatgrass	*	
	Prairie Dropseed	*	5
	Sand Dropseed	*	
	Other Perennial Grasses	*	
	Threadleaf Sedge	*	
	Penn Sedge	*	10
	Other Sedge/Rushes	*	
Forbs (5% to 15% of Total)	Dotted Gayfeather	*	
	Fringed Sagewort	*	
	Rush Skeletonplant	*	
	Green Sagewort	*	10
	Purple Prairieclover	*	
	Western Yarrow	*	
	Other Perennial Forbs	*	
Shrubs and Trees (5% to 15% of Total)	Broom Snakeweed	*	
	Prairie Rose	*	5
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	1100 to 1200
Average	900 to 1000
Unfavorable	700 to 800

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	0.30 to 0.40
Good	0.20 to 0.30
Fair	0.10 to 0.20
Poor	0.05 to 0.10

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 56)--(continued)

Wet Meadow Range Site

Plant Community			
Characteristic Vegetation	Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Fescue Sedge		5
	Northern Reedgrass		5
	Prairie Cordgrass		5
	Switchgrass		5
	Fowl Bluegrass	*	
	Mat Muhly	*	5
	Other Perennial Grasses	*	
	Slim Sedge	*	60
	Wooly Sedge	*	
	Baltic Rush	*	
	Common Spikerush	*	5
	Other Sedge/Rushes	*	
Forbs (5% to 15% of Total)	Field Mint	*	
	Indian Hemp	*	
	Ryberg's Sunflower	*	10
	Tall Goldenrod	*	
	Tall White Aster	*	
	Other Perennial Forbs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	4500 to 4800
Average	4100 to 4400
Unfavorable	3700 to 4000

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	1.35 to 1.80
Good	0.90 to 1.35
Fair	0.45 to 0.90
Poor	0.10 to 0.45

*Indicates the composition for species group
**Animal units per month

Table 12.— Range Site Descriptions (MLRA 56)--(continued)

Wetland Range Site

Characteristic Vegetation	Plant Community: Common Name		Composition By Weight (percent)
Grasses and Grasslikes (70% to 90% of Total)	Rivergrass		35
	Prairie Cordgrass		5
	American Mannagrass	*	
	American Sloughgrass	*	5
	Other Perennial Grasses	*	
	Baltic Rush	*	
	Common Spikerush	*	5
	Other Sedge/Rushes	*	
	Beaked Sedge	*	40
	Slough Sedge	*	
	Slim Sedge	*	5
	Wooly Sedge	*	
Forbs (5% to 15% of Total)	Dock Species	*	
	Longroot Smartweed	*	
	Waterparsnip	*	5
	Waterplaintain	*	
	Other Perennial Forbs	*	
Shrubs and Trees	Willow Species	*	Trace
	Other Perennial Shrubs	*	

Total Annual Production	(Excellent Condition)
Climatic Condition	Pounds Per Acre (dry)
Favorable	6600 to 7000
Average	6100 to 6500
Unfavorable	5600 to 6000

Stocking Rates	
Condition Class	**AUM Per Acre Per Year
Excellent	1.95 to 2.60
Good	1.30 to 1.95
Fair	0.65 to 1.30
Poor	0.10 to 0.65

*Indicates the composition for species group
**Animal units per month

Recreation

Public areas in the survey area provide opportunities for numerous recreational activities, including: fishing, hiking, bird-watching, and hunting. For information on recreational activities within the survey area contact the North Dakota State Department of Parks and Recreation.

Soils in the survey area are rated in Table 13, "Recreational Development," according to limitations affecting their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture, of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, ability of the soil to support vegetation, access to water, potential water impoundment sites, and either access to public sewer lines or the capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degrees, for recreational uses by the duration of flooding and the season when it occurs. Onsite assessment of the height, duration, intensity, and frequency of flooding is essential in planning recreational facilities.

Camp areas are tracts of land used intensively as sites for tents, trailers, and campers and for outdoor activities that accompany such sites. These areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. Soils are rated on the basis of soil properties that influence ease of developing camp areas and performance of the areas after development. Also considered are soil properties that influence trafficability and promote the growth of vegetation after heavy use.

Picnic areas are natural or landscaped tracts of land subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. Soils are rated on the basis of soil properties influencing cost of shaping the site, trafficability, and growth of vegetation after development. The surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry.

Playgrounds are areas used intensively for baseball, football, or similar activities. These areas require a nearly level soil that is free of stones and can withstand heavy foot traffic and maintain an adequate cover of vegetation. Soils are rated on the basis of soil properties influencing the cost of shaping the site, trafficability, and the growth of vegetation. Slope and stoniness are the main concerns in developing playgrounds. The surface of the playgrounds should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry.

Paths and trails are areas used for hiking and horseback riding. The areas should require little or no cutting and filling during site preparation. Soils are rated on the basis of soil properties influencing trafficability and erodibility. Paths and trails should remain firm under foot traffic and not be dusty when dry.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Interpretative ratings in Table 13 help engineers, planners, and others understand how soil properties influence recreational uses. Ratings for proposed uses are given in terms of limitations. Only the most restrictive features are listed. Other features may limit a specific recreational use.

The degree of soil limitation is expressed as **slight, moderate,** or **severe.**

Slight means soil properties are generally favorable for the rated use. Limitations are minor and can be easily overcome. Good performance and low maintenance are expected.

Moderate means soil properties are moderately favorable for the rated use. Limitations can be overcome or modified by special planning, design, or maintenance. During some part of the year, the expected performance may be less desirable than soils rated slight.

Severe means soil properties are unfavorable for the rated use. Examples of limitations are slope, bedrock near the surface, flooding, and a seasonal high water table. These limitations generally require major soil reclamation, special design, or intensive maintenance. Overcoming the limitations generally is difficult and costly.

Information in Table 13, "Recreational Development," can be supplemented by other information in this survey. For example, interpretations for dwellings without basements and for local roads and streets in Table 15, "Building Site Development," and interpretations for septic tank absorption fields in Table 16, "Sanitary Facilities," can supplement information obtained from Table 13.

Table 13.—Recreational Development

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." Dashes (—) indicate that the map unit component was not rated.) The information in this table indicates the dominate soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
64:					
Arveson	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness
76:					
Arvilla	Slight	Slight	Moderate: slope	Slight	Moderate: droughty
86:					
Aylmer	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy	Moderate: wetness droughty
Bantry	Severe: too sandy wetness	Severe: too sandy	Severe: too sandy wetness	Severe: too sandy	Moderate: wetness droughty
118:					
Barnes	Slight	Slight	Moderate: slope small stones	Slight	Slight
Buse	Slight	Slight	Moderate: slope small stones	Slight	Slight
120:					
Barnes	Slight	Slight	Moderate: slope small stones	Slight	Slight
Buse	Slight	Slight	Severe: slope	Slight	Slight
154:					
Barnes	Slight	Slight	Moderate: slope small stones	Slight	Slight
Svea	Slight	Slight	Moderate: slope small stones	Slight	Slight
156:					
Barnes	Slight	Slight	Moderate: slope small stones	Slight	Slight
Svea	Slight	Slight	Moderate: slope small stones	Slight	Slight
314:					
Buse	Moderate: slope	Moderate: slope	Severe: slope	Slight	Moderate: slope
Barnes	Slight	Slight	Moderate: slope small stones	Slight	Slight

Table 13.--Recreational Development--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." Dashes (--) indicate that the map unit component was not rated.) The information in this table indicates the dominate soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
450:					
Colvin	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness
493:					
Darnen	Slight	Slight	Moderate: slope	Slight	Slight
510:					
Divide	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness
571:					
Embden	Slight	Slight	Slight	Slight	Slight
726:					
Fordville	Slight	Slight	Slight	Slight	Slight
772:					
Gardena	Slight	Slight	Slight	Slight	Slight
Eckman	Slight	Slight	Slight	Slight	Slight
794:					
Glyndon	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness
795:					
Glyndon, saline	Severe: excess salt	Severe: excess salt	Severe: excess salt	Moderate: wetness	Severe: excess salt
852:					
Hamar	Severe: wetness	Moderate: wetness	Severe: wetness	Moderate: wetness	Moderate: wetness droughty
883:					
Hamerly	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness
Tonka	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding
Parnell	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding
939:					
Hecla	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy	Moderate: droughty
Hamar	Severe: wetness	Moderate: wetness	Severe: wetness	Moderate: wetness	Moderate: wetness droughty
1030:					
Kranzburg	Slight	Slight	Moderate: slope	Slight	Slight
Lismore	Slight	Slight	Moderate: slope	Slight	Slight

Table 13.—Recreational Development--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." Dashes (—) indicate that the map unit component was not rated.) The information in this table indicates the dominate soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1043:					
La Prairie	Severe: flooding	Slight	Slight	Slight	Slight
1055:					
LaDelle	Severe: flooding	Slight	Slight	Slight	Slight
1081:					
Lamoure	Severe: flooding wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness
1168:					
Lismore	Slight	Slight	Slight	Slight	Slight
Kranzburg	Slight	Slight	Slight	Slight	Slight
1205:					
Maddock	Moderate: slope too sandy	Moderate: slope too sandy	Severe: slope	Moderate: too sandy	Moderate: slope droughty
1221:					
Maddock	Moderate: too sandy	Moderate: too sandy	Moderate: slope too sandy	Moderate: too sandy	Moderate: droughty
Hecla	Moderate: too sandy	Moderate: too sandy	Moderate: slope too sandy	Moderate: too sandy	Moderate: droughty
1269:					
Marysland	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness
1403:					
Overly	Slight	Slight	Slight	Slight	Slight
1427:					
Parnell	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding
1466:					
Pits, gravel and sand	Severe: slope small stones	Severe: slope too sandy	Severe: slope small stones	Severe: slope too sandy	Severe: slope small stones droughty
1472:					
Rauville	Severe: flooding wetness	Severe: wetness	Severe: flooding wetness	Severe: wetness	Severe: flooding wetness
1523:					
Renshaw	Slight	Slight	Slight	Slight	Moderate: droughty

Table 13.--Recreational Development--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." Dashes (--) indicate that the map unit component was not rated.) The information in this table indicates the dominate soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1560:					
Rifle	Severe: excess humus ponding	Severe: excess humus ponding	Severe: excess humus ponding	Severe: excess humus ponding	Severe: excess humus ponding
1577:					
Rosewood	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness
1648:					
Serden	Severe: slope too sandy	Severe: slope too sandy	Severe: slope too sandy	Severe: too sandy	Severe: slope
Duneland	Severe: slope too sandy	Severe: slope too sandy	Severe: slope too sandy	Severe: too sandy	Severe: slope droughty
1670:					
Ulen	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness
Rosewood	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness
1704:					
Sioux	Slight	Slight	Moderate: slope small stones	Slight	Severe: droughty
Renshaw	Slight	Slight	Moderate: slope	Slight	Moderate: droughty
1709:					
Southam	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding
1772:					
Svea	Slight	Slight	Moderate: slope small stones	Slight	Slight
Gardena	Slight	Slight	Slight	Slight	Slight
1788:					
Swenoda	Slight	Slight	Slight	Slight	Slight
Barnes	Slight	Slight	Moderate: slope small stones	Slight	Slight
1834:					
Tonka	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding
1842:					
Towner	Moderate: too sandy	Moderate: too sandy	Moderate: slope too sandy	Moderate: too sandy	Moderate: droughty

Table 13.--Recreational Development--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." Dashes (--) indicate that the map unit component was not rated.) The information in this table indicates the dominate soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1859:					
Ulen	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness
1871:					
Vallers, saline	Severe: excess salt wetness	Severe: excess salt wetness	Severe: excess salt wetness	Severe: wetness	Severe: excess salt wetness
1883:					
Vallers	Severe: wetness	Moderate: percs slowly wetness	Severe: wetness	Moderate: wetness	Moderate: wetness
Parnell	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding
1935:					
Venlo	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding
1953:					
Wahpeton	Severe: flooding	Moderate: too clayey	Moderate: flooding too clayey	Moderate: too clayey	Severe: too clayey
1978:					
Water	--	--	--	--	--
2049:					
Wyndmere	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness
2091:					
Zell	Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope
2206:					
Barnes	Slight	Slight	Moderate: slope small stones	Slight	Slight
Sioux	Slight	Slight	Severe: slope	Slight	Severe: droughty
2207:					
Bearden	Moderate: percs slowly wetness	Moderate: percs slowly wetness	Moderate: percs slowly wetness	Moderate: wetness	Moderate
2208:					
Brantford	Slight	Slight	Moderate: small stones	Slight	Moderate: droughty
Coe	Slight	Slight	Moderate: slope	Slight	Severe: droughty

Table 13.—Recreational Development--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." Dashes (-) indicate that the map unit component was not rated.) The information in this table indicates the dominate soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
2209:					
Buse	Moderate: slope	Moderate: slope	Severe: slope	Slight	Moderate: slope
Barnes	Slight	Slight	Moderate: slope small stones	Slight	Slight
2210:					
Cathay	Severe: excess sodium	Severe: excess sodium	Severe: excess sodium large stones	Moderate: large stones	Severe: excess sodium large stones
Larson	Severe: excess sodium	Severe: excess sodium	Severe: excess sodium large stones	Moderate: large stones	Severe: excess sodium large stones
2211:					
Eckman	Slight	Slight	Moderate: slope	Slight	Slight
Gardena	Slight	Slight	Moderate: slope	Slight	Slight
2212:					
Eckman	Slight	Slight	Moderate: slope	Slight	Slight
Zell	Slight	Slight	Severe: slope	Slight	Slight
2213:					
Eckman	Slight	Slight	Severe: slope	Slight	Slight
Zell	Slight	Slight	Severe: slope	Slight	Slight
2214:					
Exline	Severe: excess sodium	Severe: excess sodium	Severe: excess sodium	Moderate: wetness	Severe: excess sodium
2215:					
Fairdale	Severe: flooding	Slight	Moderate: slope	Slight	Slight
2216:					
Gwinner	Slight	Slight	Slight	Slight	Slight
Peever	Slight	Slight	Slight	Slight	Slight
Parnell	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding
2217:					
Hamerly	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness

Table 13.--Recreational Development--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." Dashes (--) indicate that the map unit component was not rated.) The information in this table indicates the dominate soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
2217: (con't)					
Buse	Slight	Slight	Moderate: slope small stones	Slight	Slight
Parnell	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding
2218:					
Brantford	Slight	Slight	Moderate: small stones	Slight	Moderate: droughty
Vang	Slight	Slight	Moderate: slope	Slight	Slight
2219:					
Hegne	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness
2220:					
Letcher	Severe: excess sodium	Severe: excess sodium	Severe: excess sodium	Slight	Severe: excess sodium
Lemert	Severe: excess sodium	Severe: excess sodium	Severe: excess sodium	Slight	Severe: excess sodium
2221:					
Falsen	Slight	Slight	Slight	Slight	Moderate: droughty
2222:					
Peever	Slight	Slight	Moderate: slope	Slight	Slight
Gwinner	Slight	Slight	Moderate: slope	Slight	Slight
2223:					
Renshaw	Slight	Slight	Moderate: slope	Slight	Moderate: droughty
Sioux	Slight	Slight	Moderate: slope small stones	Slight	Severe: droughty
2224:					
Serden	Severe: too sandy	Severe: too sandy	Severe: slope too sandy	Severe: too sandy	Moderate: slope droughty
Hamar	Severe: wetness	Moderate: wetness	Severe: wetness	Moderate: wetness	Moderate: wetness droughty

Table 13.--Recreational Development--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." Dashes (--) indicate that the map unit component was not rated.) The information in this table indicates the dominate soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
2225:					
Sioux------------------	Moderate: slope small stones	Moderate: slope small stones	Severe: large stones slope small stones	Severe: large stones	Severe: large stones droughty
2226:					
Stirum-----------------	Severe: excess sodium wetness	Severe: excess sodium wetness	Severe: excess sodium wetness	Severe: wetness	Severe: excess sodium wetness
Lemert-----------------	Severe: excess sodium	Severe: excess sodium	Severe: excess sodium	Slight	Severe: excess sodium
2228:					
Aylmer-----------------	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy	Moderate: wetness droughty
Rosewood---------------	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness
Serden-----------------	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy	Moderate: droughty

Wildlife Habitat

Soils affect the kind and amount of vegetation that is available to wildlife for food and cover. They also affect the construction of water impoundments. If food, cover, or water is missing, inadequate, or inaccessible, wildlife will be scarce or will not inhabit the area.

If the soils have potential for habitat development, wildlife habitat can be created or improved by planting appropriate vegetation, properly managing existing plant cover, and fostering the natural establishment of desirable plants.

In Table 14,"Wildlife Habitat," soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife. It can also be used for selecting soils suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil for wildlife habitat is rated **good, fair, poor,** or **very poor**. A rating of **good** indicates the kind of habitat is easily established, improved, or maintained. Few or no limitations affect management and satisfactory results can be expected. A rating of **fair** indicates the kind of wildlife habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of **poor** indicates limitations are severe for the designated kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of **very poor** indicates restrictions for the element or kind of wildlife habitat are very severe and unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat shown on Table 14 are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants used by wildlife. Examples are wheat, rye, oats, corn, sunflower, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes planted for wildlife food and cover. Examples are smooth bromegrass, intermediate wheatgrass, tall wheatgrass, sweetclover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Examples are big bluestem, goldenrod, blue grama, green needlegrass and western wheatgrass. The major soil properties affecting the growth of grain and forage crops and wild herbaceous plants are depth of the root zone, texture of the surface layer, the amount of water available to plants, wetness, salinity or sodicity, and flooding. The length of the growing season also is important.

Hardwood trees produce nuts or other fruit, buds, catkins, twigs, bark, and foliage that wildlife eat. Examples are oak, poplar, boxelder, green ash, willow, and American elm. Examples of fruit-producing shrubs that are suitable for planting on soils that have good potential for these plants are hawthorn, American plum, redosier dogwood, chokecherry, serviceberry, and silver buffaloberry.

Coniferous plants are cone-bearing trees, shrubs, or ground cover that provide habitat or supply food in the form of browse, seed, or fruitlike cones. Examples are pine, spruce, cedar, and juniper.

The major soil properties affecting the growth of hardwood and coniferous trees and shrubs are depth of root zone, the amount of water available to plants, and wetness.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the rooting zone, available water capacity, salinity, and soil moisture. Examples of shrubs are common chokecherry, buffaloberry, snowberry, juneberry, hawthorn, American plum, and redosier dogwood

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Wetland plants produce food or cover for wetland wildlife. Examples of these plants are smartweed,

sedges, bulrushes, white top, common reedgrass, saltgrass, prairie cordgrass, and cattail.

The major soil properties affecting wetland plants are texture of the surface layer, wetness, acidity or alkalinity, and slope.

Shallow water areas have an average depth of less than 5 feet. They are useful as habitat for some wildlife species. They are naturally wet areas or are created by dams, levees, or water-control measures in marshes or streams. Examples are muskrat marshes, waterfowl feeding areas, wildlife watering developments, beaver ponds, and other wildlife ponds.

The major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and saturated hydraulic conductivity.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, and shrubs. These areas produce grain and seed crops, grasses and legumes and wild herbaceous plants. Wildlife attracted to these areas include Hungarian partridge, pheasant, sharptail grouse, western meadowlark, lark bunting, cottontail rabbit, and red fox.

Habitat for woodland wildlife consists of areas of hardwoods or conifers or a mixture of these and associated grasses, legumes, and wild herbaceous plants (fig. 15). Wildlife attracted to this habitat include thrushes, woodpeckers, owls, tree squirrels, raccoon, turkeys, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy, shallow water areas that support water-tolerant plants. The wildlife attracted to this habitat include ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. The wildlife attracted to rangeland include coyote, deer, sharptail grouse, western meadowlark, and David's sparrow.

Figure 15. An area of Darnen loam, 3 to 6 percent slopes, on toeslopes. Buse and Barnes soils on the wooded side slopes are dominated by green ash and oak and provide good habitat for deer, turkeys, and other wildlife.

Table 14.--Wildlife Habitat

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor." Dashes (--) indicate the map unit componet was not rated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
64:												
Arveson	Poor	Fair	Fair	--	--	Fair	Good	Good	Fair	--	Good	Fair
76:												
Arvilla	Fair	Good	Fair	Fair	Fair	Poor	Very poor	Very poor	Fair	Fair	Very poor	Poor
86:												
Aylmer	Poor	Fair	Good	Poor	Poor	Fair	Poor	Very poor	Fair	Fair	Very poor	Fair
Bantry	Poor	Fair	Good	Fair	Fair	Fair	Fair	Very poor	Fair	Fair	Poor	Fair
118:												
Barnes	Good	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
Buse	Fair	Good	Fair	--	--	Fair	Very poor	Very poor	Fair	--	Very poor	Fair
120:												
Barnes	Good	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
Buse	Fair	Good	Fair	--	--	Fair	Very poor	Very poor	Fair	--	Very poor	Fair
154:												
Barnes	Good	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
Svea	Good	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
156:												
Barnes	Good	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
Svea	Good	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
314:												
Buse	Poor	Fair	Fair	--	--	Fair	Very poor	Very poor	Fair	--	Very poor	Fair
Barnes	Good	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
450:												
Colvin	Poor	Fair	Fair	Fair	Fair	Fair	Good	Good	Poor	Fair	Good	Fair
493:												
Darnen	Good	Good	Good	--	--	Fair	Poor	Poor	Good	--	Poor	Fair

Table 14.--Wildlife Habitat--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor." Dashes (--) indicate the map unit componet was not rated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
510:												
Divide	Fair	Fair	Good	Good	Good	Fair	Fair	Very poor	Fair	Good	Poor	Fair
571:												
Embden	Fair	Good	Good	Good	Good	Fair	Poor	Poor	Good	Good	Poor	Fair
726:												
Fordville	Good	Good	Good	--	--	Fair	Very poor	Very poor	Good	--	Very poor	Fair
772:												
Gardena	Good	Good	Good	Good	Good	Fair	Poor	Poor	Good	Good	Poor	Fair
Eckman	Good	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
794:												
Glyndon	Good	Good	Good	Fair	Poor	Fair	Poor	Poor	Good	Fair	Poor	Fair
795:												
Glyndon, saline	Fair	Fair	Good	Poor	Poor	Fair	Poor	Poor	Fair	Poor	Poor	Fair
852:												
Hamar	Poor	Good	Fair	Good	Very poor	Fair	Fair	Fair	Fair	Very poor	Fair	Fair
883:												
Hamerly	Good	Good	Good	Good	Good	Fair	Fair	Fair	Good	Good	Fair	Fair
Tonka	Poor	Fair	Fair	Fair	Fair	Poor	Good	Good	Poor	Fair	Good	Poor
Parnell	Very poor	Poor	Poor	Very poor	Very poor	Poor	Good	Good	Poor	Very poor	Good	Poor
939:												
Hecla	Fair	Good	Good	--	--	Fair	Poor	Poor	Good	--	Poor	Fair
Hamar	Poor	Good	Fair	Good	Very poor	Fair	Fair	Fair	Fair	Very poor	Fair	Fair
1030:												
Kranzburg	Good	Good	Good	Good	Very poor	--	Poor	Very poor	Good	Very poor	Very poor	Good
Lismore	Good	Good	Good	Good	Very poor	--	Very poor	Very poor	Good	Very poor	Very poor	Good
1043:												
La Prairie	Good	Good	Fair	Good	Good	--	Very poor	Very poor	Good	Good	Very poor	Fair
1055:												
LaDelle	Good	Good	Good	Good	Very poor	Good	Very poor	Very poor	Good	Very poor	Very poor	Good

Table 14.--Wildlife Habitat--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor." Dashes (--) indicate the map unit componet was not rated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
1081:												
Lamoure	Poor	Fair	Fair	--	--	Fair	Good	Good	Fair	--	Good	Fair
1168:												
Lismore	Good	Good	Good	Good	Very poor	--	Very poor	Very poor	Good	Very poor	Very poor	Good
Kranzburg	Good	Good	Good	Good	Very poor	--	Poor	Very poor	Good	Very poor	Very poor	Good
1205:												
Maddock	Poor	Fair	Good	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor	Fair
1221:												
Maddock	Fair	Good	Good	Fair	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor	Fair
Hecla	Fair	Good	Good	--	--	Fair	Poor	Poor	Good	--	Poor	Fair
1269:												
Marysland	Poor	Fair	Fair	--	--	Fair	Good	Good	Fair	--	Good	Fair
1403:												
Overly	Good	Good	Good	Good	Good	Fair	Poor	Poor	Good	Good	Poor	Fair
1427:												
Parnell	Very poor	Poor	Poor	Very poor	Very poor	Poor	Good	Good	Poor	Very poor	Good	Poor
1466:												
Pits, gravel and sand	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor
1472:												
Rauville	Very poor	Poor	Fair	Poor	Very poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair
1523:												
Renshaw	Poor	Fair	Poor	Poor	Very poor	Poor	Very poor	Very poor	Poor	Very poor	Very poor	Poor
1560:												
Rifle	Very poor	Poor	Poor	Poor	Poor	--	Good	Good	Poor	Poor	Good	--
1577:												
Rosewood	Poor	Fair	Fair	--	--	Fair	Good	Good	Fair	--	Good	Fair
1648:												
Serden	Very poor	Very poor	Fair	Poor	Poor	Good	Very poor	Very poor	Poor	Poor	Very poor	Fair
Duneland	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor

Table 14.--Wildlife Habitat--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor." Dashes (--) indicate the map unit componet was not rated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life	Range- land wild- life
1670:												
Ulen	Fair	Good	Good	---	---	Fair	Poor	Poor	Good	---	Poor	Fair
Rosewood	Poor	Fair	Fair	---	---	Fair	Good	Good	Fair	---	Good	Fair
1704:												
Sioux	Very poor	Very poor	Poor	Poor	Very poor	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Poor
Renshaw	Poor	Fair	Poor	Poor	Very poor	Poor	Very poor	Very poor	Poor	Very poor	Very poor	Poor
1709:												
Southam	Very poor	Very poor	Very poor	---	---	Very poor	Good	Good	Very poor	---	Good	Very poor
1772:												
Svea	Good	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
Gardena	Good	Good	Good	Good	Good	Fair	Poor	Poor	Good	Good	Poor	Fair
1788:												
Swenoda	Fair	Good	Good	---	---	Fair	Very poor	Very poor	Good	---	Very poor	Fair
Barnes	Good	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
1834:												
Tonka	Poor	Fair	Fair	Fair	Fair	Poor	Good	Good	Poor	Fair	Good	Poor
1842:												
Towner	Fair	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
1859:												
Ulen	Fair	Good	Good	---	---	Fair	Poor	Poor	Good	---	Poor	Fair
1871:												
Vallers, saline	Poor	Fair	Very poor	---	---	Very poor	Good	Good	Poor	---	Good	Very poor
1883:												
Vallers	Poor	Fair	Fair	---	---	Fair	Good	Good	Fair	---	Good	Fair
Parnell	Very poor	Poor	Poor	Very poor	Very poor	Poor	Good	Good	Poor	Very poor	Good	Poor
1935:												
Venlo	Very poor	Poor	Poor	---	---	Poor	Good	Good	Poor	---	Good	Poor
1953:												
Wahpeton	Good	Good	Fair	Good	Good	Poor	Poor	Poor	Fair	Good	Poor	Poor

Table 14.--Wildlife Habitat--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor." Dashes (--) indicate the map unit componet was not rated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life	Range- land wild- life
1978:												
Water	---	---	---	---	---	---	---	---	---	---	---	---
2049:												
Wyndmere	Fair	Good	Good	Good	Good	Fair	Fair	Poor	Good	Good	Poor	Fair
2091:												
Zell	Very poor	Very poor	Good	---	---	Fair	Very poor	Very poor	Poor	---	Very poor	Fair
2206:												
Barnes	Good	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
Sioux	Very poor	Very poor	Poor	Poor	Very poor	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Poor
2207:												
Bearden	Good	Good	Good	Good	Good	Fair	Fair	Fair	Good	Good	Fair	Fair
2208:												
Brantford	Fair	Fair	Good	Fair	Fair	Poor	Poor	Poor	Fair	Fair	Very poor	Fair
Coe	Poor	Poor	Fair	---	---	Poor	Very poor	Very poor	Poor	---	Very poor	Fair
2209:												
Buse	Poor	Fair	Fair	---	---	Fair	Very poor	Very poor	Fair	---	Very poor	Fair
Barnes	Good	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
2210:												
Cathay	Poor	Poor	Good	---	---	Poor	Poor	Poor	Poor	---	Poor	Fair
Larson	Poor	Poor	Poor	---	---	Very poor	Poor	Poor	Poor	---	Poor	Very poor
2211:												
Eckman	Good	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
Gardena	Good	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
2212:												
Eckman	Good	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
Zell	Fair	Good	Good	---	---	Fair	Very poor	Very poor	Good	---	Very poor	Fair

Table 14.—Wildlife Habitat--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor." Dashes (—) indicate the map unit componet was not rated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for—: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
2213:												
Eckman	Fair	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
Zell	Fair	Good	Good	—	—	Fair	Very poor	Very poor	Good	—	Very poor	Fair
2214:												
Exline	Very poor	Very poor	Very poor	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Poor	Fair
2215:												
Fairdale	Good	Good	Good	—	—	Fair	Poor	Very poor	Good	—	Very poor	Fair
2216:												
Gwinner	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good
Peever	Good	Fair	Good	Fair	Very poor	—	Very poor	Very poor	Good	Very poor	Very poor	Good
Parnell	Very poor	Poor	Poor	Very poor	Very poor	Poor	Good	Good	Poor	Very poor	Good	Poor
2217:												
Hamerly	Good	Good	Good	Good	Good	Fair	Fair	Fair	Good	Good	Fair	Fair
Buse	Fair	Good	Fair	—	—	Fair	Very poor	Very poor	Fair	—	Very poor	Fair
Parnell	Very poor	Poor	Poor	Very poor	Very poor	Poor	Good	Good	Poor	Very poor	Good	Poor
2218:												
Brantford	Fair	Fair	Good	Fair	Fair	Poor	Poor	Poor	Fair	Fair	Very poor	Fair
Vang	Good	Good	Good	Good	Good	Fair	Poor	Poor	Good	—	Poor	Fair
2219:												
Hegne	Poor	Fair	Fair	—	—	Poor	Good	Good	Fair	—	Good	Poor
2220:												
Letcher	Poor	Poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor	Very poor	Very poor	Very poor
Lemert	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Fair	Fair	Poor	Very poor	Fair	Very poor
2221:												
Falsen	Fair	Good	Good	Poor	Poor	Fair	Poor	Very poor	Good	Fair	Very poor	Fair
2222:												
Peever	Fair	Fair	Good	Fair	Very poor	—	Very poor	Very poor	Fair	Very poor	Very poor	Good

Table 14.--Wildlife Habitat--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor." Dashes (--) indicate the map unit componet was not rated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Open- land wild- life	Wood- land wild- life	Wetland wild- life	Range- land wild- life
2222: (con't)												
Gwinner	Good	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Poor	Fair
2223:												
Renshaw	Poor	Fair	Poor	Poor	Very poor	Poor	Very poor	Very poor	Poor	Very poor	Very poor	Poor
Sioux	Very poor	Very poor	Poor	Poor	Very poor	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Poor
2224:												
Serden	Poor	Fair	Fair	Poor	Poor	Good	Very poor	Very poor	Fair	Poor	Very poor	Fair
Hamar	Poor	Good	Fair	Good	Very poor	Fair	Fair	Fair	Fair	Very poor	Fair	Fair
2225:												
Sioux	Very poor	Very poor	Poor	Poor	Very poor	---	Very poor	Very poor	Very poor	Very poor	Very poor	Poor
2226:												
Stirum	Very poor	Very poor	Very poor	Poor	Poor	Fair	Good	Fair	Very poor	Poor	Fair	Poor
Lemert	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Fair	Fair	Poor	Very poor	Fair	Very poor
2228:												
Aylmer	Poor	Fair	Good	Poor	Poor	Fair	Poor	Very poor	Fair	Fair	Very poor	Fair
Rosewood	Poor	Fair	Fair	---	---	Fair	Good	Good	Fair	---	Good	Fair
Serden	Poor	Fair	Fair	Poor	Poor	Good	Very poor	Very poor	Fair	Poor	Very poor	Fair

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the "Glossary."

Building Site Development

Table 15,"Building Site Development" shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered **slight** if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; **moderate** if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and **severe** if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth

to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills generally are limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, potential for frost action, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 16, "Sanitary Facilities" shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. It also shows the suitability of the soils for use as a daily cover for landfill.

Soil properties are important in selecting sites for sanitary facilities and in identifying limiting soil properties and site features to be considered in planning, design, and installation. Soil limitation ratings of **slight**, **moderate**, or **severe** are given for septic tank absorption fields, sewage lagoons, and trench and area sanitary landfills. Soil suitability ratings of **good**, **fair**, and **poor** are given for daily cover for landfill.

A rating of **slight** or **good** indicates that the soils have no limitations or that the limitations can be easily overcome. Good performance and low maintenance can be expected. A rating of **moderate** or **fair** indicates that the limitations should be recognized but generally can be overcome by good management or special design. A rating of **severe** or **poor** indicates that overcoming the limitations is difficult or impractical. Increased maintenance may be required.

Septic tank absorption fields are areas in which subsurface systems of tile or perforated pipe distribute effluent from a septic tank into the natural soil. The centerline of the tile is assumed to be at a depth of 24 inches. Only the part of the soil between depths of 24 and 60 inches is considered in making the ratings. The soil properties and site features considered are those that affect the absorption of the effluent, those that affect the construction and maintenance of the system, and those that may affect public health.

The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted, relatively impervious soil material. Aerobic lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Relatively

impervious soil material for the lagoon floor and sides is desirable to minimize seepage and contamination of local ground water.

Table 16, "Sanitary Facilities" gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Trench sanitary landfill is an area where solid waste is disposed of by placing refuse in successive layers in an excavated trench. The waste is spread, compacted, and covered daily with a thin layer of soil that is excavated from the trench. When the trench is full, a final cover of soil material at least 2 feet thick is placed over the landfill. Soil properties that influence the risk of pollution, the ease of excavation, trafficability, and revegetation are the major considerations in rating the soils.

Area sanitary landfill is an area where solid waste is disposed of by placing refuse in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil that is imported from a source away from the site. A final cover of soil at least 2 feet thick is placed over the completed landfill. Soil properties that influence trafficability, revegetation, and the risk of pollution are the main considerations in rating the soils for area sanitary landfills.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. The ratings in Table 16, "Sanitary Facilities" are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste. The suitability of a soil for use as cover is based on properties that affect workability and the ease of digging, moving, and spreading the material over the refuse daily during both wet and dry periods.

Soil texture, wetness, rock fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Waste Management

Soil properties are important when organic waste is applied as fertilizer and wastewater is applied in irrigated areas. They also are important when the soil is used as a medium for the treatment and disposal of the organic waste and wastewater. Unfavorable soil properties can result in environmental damage.

The use of organic waste and wastewater as production resources results in energy and resource conservation and minimizes the problems associated with waste disposal. If disposal is the goal, applying a maximum amount of the organic waste or the wastewater to a minimal area holds costs to a minimum and environmental damage is the main hazard. If reuse is the goal, a minimum amount should be applied to a maximum area and environmental damage is unlikely.

Interpretations developed for waste management may include ratings for manure- and food-processing waste, municipal sewage sludge, use of wastewater for irrigation, and treatment of wastewater by slow rate, overland flow, and rapid infiltration processes.

Specific information regarding waste management is available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Construction Materials

Table 17, "Construction Materials" gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated **good**, **fair**, or **poor** as a source of roadfill and topsoil. They are rated as a **probable** or **improbable** source of sand and gravel.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In Table 17, "Construction Materials," the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. Table 19, "Engineering Index Properties," provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated **good** contain significant amounts of sand or gravel, or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated **fair** are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated **poor** have one or more of the following characteristics: a plasticity index of more than 10, a high shrink-swell potential, many stones, slopes of more than 25 percent, or a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In Table 17, "Construction Materials," only the probability of finding material in suitable quantity in or below the soil is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is as much as 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated **good** have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated **fair** are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated **poor** are very sandy or clayey, have less than 20 inches of suitable material, have a large

amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils generally is preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 18, "Water Management" gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered **slight** if soil properties and site features generally are favorable for the indicated use and limitations are minor and are easily overcome; **moderate** if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and **severe** if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives, for each soil, the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In Table 18, "Water Management," the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even more than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff.

Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct

surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Table 15.—Building Site Development

(Some terms that describe retrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
64:						
Arveson	Severe: wetness cutbanks cave	Severe: wetness	Severe: wetness	Severe: wetness	Severe: frost action wetness	Severe: wetness
76:						
Arvilla	Severe: cutbanks cave	Slight	Slight	Slight	Slight	Moderate: droughty
86:						
Aylmer	Severe: wetness cutbanks cave	Moderate: wetness	Severe: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness droughty
Bantry	Severe: wetness cutbanks cave	Severe: wetness	Severe: wetness	Severe: wetness	Moderate: wetness	Moderate: wetness droughty
118:						
Barnes	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell slope	Severe: low strength	Slight
Buse	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell slope	Severe: low strength	Slight
120:						
Barnes	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell slope	Severe: low strength	Slight
Buse	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell slope	Severe: low strength	Slight
154:						
Barnes	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell slope	Severe: low strength	Slight
Svea	Moderate: wetness	Moderate: shrink-swell	Moderate: shrink-swell wetness	Moderate: shrink-swell slope	Severe: low strength	Slight
156:						
Barnes	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell slope	Severe: low strength	Slight
Svea	Moderate: wetness	Moderate: shrink-swell	Moderate: shrink-swell wetness	Moderate: shrink-swell slope	Severe: low strength	Slight
314:						
Buse	Moderate: slope	Moderate: shrink-swell slope	Moderate: shrink-swell slope	Severe: slope	Severe: low strength	Moderate: slope

Table 15.--Building Site Development--(continued)

(Some terms that describe retrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
314: (con't)						
Barnes	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell slope	Severe: low strength	Slight
450:						
Colvin	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: frost action low strength wetness	Severe: wetness
493:						
Darnen	Severe: excess humus	Severe: low strength	Moderate: shrink-swell	Severe: low strength	Moderate: frost action	Slight
510:						
Divide	Severe: wetness cutbanks cave	Moderate: wetness	Severe: wetness	Moderate: wetness	Moderate: frost action wetness	Moderate: wetness
571:						
Embden	Severe: cutbanks cave	Slight	Moderate: wetness	Slight	Moderate: frost action	Slight
726:						
Fordville	Severe: cutbanks cave	Slight	Slight	Slight	Slight	Slight
772:						
Gardena	Moderate: wetness	Slight	Moderate: wetness	Slight	Severe: frost action	Slight
Eckman	Slight	Slight	Slight	Slight	Severe: frost action	Slight
794:						
Glyndon	Severe: cutbanks cave	Slight	Moderate: wetness	Slight	Severe: frost action	Moderate: wetness
795:						
Glyndon, saline	Severe: wetness cutbanks cave	Moderate: wetness	Severe: wetness	Moderate: wetness	Severe: frost action	Severe: excess salt
852:						
Hamar	Severe: wetness cutbanks cave	Severe: wetness	Severe: wetness	Severe: wetness	Moderate: frost action wetness	Moderate: wetness droughty
883:						
Hamerly	Severe: wetness	Moderate: shrink-swell wetness	Severe: wetness	Moderate: shrink-swell wetness	Severe: frost action	Moderate: wetness
Tonka	Severe: ponding	Severe: shrink-swell ponding	Severe: shrink-swell ponding	Severe: shrink-swell ponding	Severe: low strength shrink-swell ponding	Severe: ponding

Table 15.—Building Site Development--(continued)

(Some terms that describe retrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
883: (con't)						
Parnell	Severe: excess humus ponding	Severe: shrink-swell ponding	Severe: shrink-swell ponding	Severe: shrink-swell ponding	Severe: low strength shrink-swell ponding	Severe: ponding
939:						
Hecla	Severe: cutbanks cave	Slight	Moderate: wetness	Slight	Moderate: frost action	Moderate: droughty
Hamar	Severe: wetness cutbanks cave	Severe: wetness	Severe: wetness	Severe: wetness	Moderate: frost action wetness	Moderate: wetness droughty
1030:						
Kranzburg	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell slope	Severe: frost action low strength	Slight
Lismore	Moderate: wetness	Moderate: shrink-swell	Moderate: shrink-swell wetness	Moderate: shrink-swell slope	Severe: frost action low strength	Slight
1043:						
La Prairie	Moderate: wetness	Severe: flooding	Severe: flooding	Severe: flooding	Severe: low strength	Slight
1055:						
LaDelle	Moderate: wetness	Severe: flooding	Severe: flooding	Severe: flooding	Severe: frost action low strength	Slight
1081:						
Lamoure	Severe: wetness	Severe: flooding wetness	Severe: flooding wetness	Severe: flooding wetness	Severe: low strength wetness	Severe: wetness
1168:						
Lismore	Moderate: wetness	Moderate: shrink-swell	Moderate: shrink-swell wetness	Moderate: shrink-swell	Severe: frost action low strength	Slight
Kranzburg	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell	Severe: frost action low strength	Slight
1205:						
Maddock	Severe: cutbanks cave	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope droughty
1221:						
Maddock	Severe: cutbanks cave	Slight	Slight	Slight	Slight	Moderate: droughty
Hecla	Severe: cutbanks cave	Slight	Moderate: wetness	Slight	Moderate: frost action	Moderate: droughty

Table 15.—Building Site Development--(continued)

(Some terms that describe retrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1269:						
Marysland	Severe: wetness cutbanks cave	Severe: wetness	Severe: wetness	Severe: wetness	Severe: frost action wetness	Severe: wetness
1403:						
Overly	Moderate: too clayey wetness	Moderate: shrink-swell	Moderate: shrink-swell wetness	Moderate: shrink-swell	Severe: frost action low strength	Slight
1427:						
Parnell	Severe: excess humus ponding	Severe: shrink-swell ponding	Severe: shrink-swell ponding	Severe: shrink-swell ponding	Severe: low strength shrink-swell ponding	Severe: ponding
1466:						
Pits, gravel and sand	Severe: slope cutbanks cave	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope small stones droughty
1472:						
Rauville	Severe: wetness cutbanks cave	Severe: flooding wetness	Severe: flooding wetness	Severe: flooding wetness	Severe: flooding low strength wetness	Severe: flooding wetness
1523:						
Renshaw	Severe: cutbanks cave	Slight	Slight	Slight	Slight	Moderate: droughty
1560:						
Rifle	Severe: excess humus ponding	Severe: low strength ponding	Severe: low strength ponding	Severe: low strength ponding	Severe: frost action ponding	Severe: excess humus ponding
1577:						
Rosewood	Severe: wetness cutbanks cave	Severe: wetness	Severe: wetness	Severe: wetness	Severe: frost action wetness	Severe: wetness
1648:						
Serden	Severe: slope cutbanks cave	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Duneland	Severe: slope cutbanks cave	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope droughty
1670:						
Ulen	Severe: cutbanks cave	Slight	Moderate: wetness	Slight	Moderate: frost action	Moderate: wetness
Rosewood	Severe: wetness cutbanks cave	Severe: wetness	Severe: wetness	Severe: wetness	Severe: frost action wetness	Severe: wetness

Table 15.--Building Site Development--(continued)

(Some terms that describe retrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1704:						
Sioux	Severe: cutbanks cave	Slight	Slight	Slight	Slight	Severe: droughty
Renshaw	Severe: cutbanks cave	Slight	Slight	Slight	Slight	Moderate: droughty
1709:						
Southam	Severe: ponding	Severe: shrink-swell ponding	Severe: shrink-swell ponding	Severe: shrink-swell ponding	Severe: low strength shrink-swell ponding	Severe: ponding
1772:						
Svea	Moderate: wetness	Moderate: shrink-swell	Moderate: shrink-swell wetness	Moderate: shrink-swell slope	Severe: low strength	Slight
Gardena	Moderate: wetness	Slight	Moderate: wetness	Slight	Severe: frost action	Slight
1788:						
Swenoda	Moderate: wetness	Slight	Moderate: shrink-swell wetness	Slight	Moderate: frost action	Slight
Barnes	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell slope	Severe: low strength	Slight
1834:						
Tonka	Severe: ponding	Severe: shrink-swell ponding	Severe: shrink-swell ponding	Severe: shrink-swell ponding	Severe: low strength shrink-swell ponding	Severe: ponding
1842:						
Towner	Severe: cutbanks cave	Slight	Moderate: shrink-swell wetness	Slight	Moderate: frost action	Moderate: droughty
1859:						
Ulen	Severe: cutbanks cave	Slight	Moderate: wetness	Slight	Moderate: frost action	Moderate: wetness
1871:						
Vallers, saline	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: frost action low strength wetness	Severe: excess salt wetness
1883:						
Vallers	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: frost action	Moderate: wetness
Parnell	Severe: excess humus ponding	Severe: shrink-swell ponding	Severe: shrink-swell ponding	Severe: shrink-swell ponding	Severe: low strength shrink-swell ponding	Severe: ponding

Table 15.—Building Site Development--(continued)

(Some terms that describe retrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1935:						
Venlo	Severe: ponding cutbanks cave	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding
1953:						
Wahpeton	Moderate: flooding too clayey	Severe: flooding shrink-swell	Severe: flooding shrink-swell	Severe: flooding shrink-swell	Severe: flooding low strength shrink-swell	Severe: too clayey
1978:						
Water	—	—	—	—	—	—
2049:						
Wyndmere	Severe: wetness cutbanks cave	Moderate: wetness	Severe: wetness	Moderate: wetness	Severe: frost action	Moderate: wetness
2091:						
Zell	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: frost action slope	Severe: slope
2206:						
Barnes	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell slope	Severe: low strength	Slight
Sioux	Severe: cutbanks cave	Slight	Slight	Moderate: slope	Slight	Severe: droughty
2207:						
Bearden	Severe: wetness cutbanks cave	Moderate: shrink-swell wetness	Severe: wetness	Moderate: shrink-swell wetness	Severe: frost action low strength	Moderate
2208:						
Brantford	Severe: cutbanks cave	Slight	Slight	Slight	Slight	Moderate: droughty
Coe	Severe: cutbanks cave	Slight	Slight	Slight	Slight	Severe: droughty
2209:						
Buse	Moderate: slope	Moderate: shrink-swell slope	Moderate: shrink-swell slope	Severe: slope	Severe: low strength	Moderate: slope
Barnes	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell slope	Severe: low strength	Slight
2210:						
Cathay	Moderate: large stones wetness	Moderate: large stones shrink-swell	Moderate: large stones shrink-swell wetness	Moderate: large stones shrink-swell	Severe: low strength	Severe: excess sodium large stones

Table 15.—Building Site Development--(continued)

(Some terms that describe retrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
2210: (con't)						
Larson	Moderate: large stones wetness	Moderate: large stones shrink-swell	Moderate: large stones shrink-swell wetness	Moderate: large stones shrink-swell	Severe: low strength	Severe: excess sodium large stones
2211:						
Eckman	Slight	Slight	Slight	Moderate: slope	Severe: frost action	Slight
Gardena	Moderate: wetness	Slight	Moderate: wetness	Moderate: slope	Severe: frost action	Slight
2212:						
Eckman	Slight	Slight	Slight	Moderate: slope	Severe: frost action	Slight
Zell	Slight	Slight	Slight	Moderate: slope	Severe: frost action	Slight
2213:						
Eckman	Slight	Slight	Slight	Moderate: slope	Severe: frost action	Slight
Zell	Slight	Slight	Slight	Moderate: slope	Severe: frost action	Slight
2214:						
Exline	Severe: wetness cutbanks cave	Severe: shrink-swell	Severe: wetness	Severe: shrink-swell	Severe: low strength shrink-swell	Severe: excess sodium
2215:						
Fairdale	Moderate: wetness	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: flooding low strength shrink-swell	Slight
2216:						
Gwinner	Moderate: too clayey wetness	Moderate: shrink-swell	Moderate: shrink-swell wetness	Moderate: shrink-swell	Severe: frost action	Slight
Peever	Moderate: too clayey	Severe: shrink-swell	Severe: shrink-swell	Severe: shrink-swell	Severe: low strength shrink-swell	Slight
Parnell	Severe: excess humus ponding	Severe: shrink-swell ponding	Severe: shrink-swell ponding	Severe: shrink-swell ponding	Severe: low strength shrink-swell ponding	Severe: ponding
2217:						
Hamerly	Severe: wetness	Moderate: shrink-swell wetness	Severe: wetness	Moderate: shrink-swell wetness	Severe: frost action	Moderate: wetness

Table 15.—Building Site Development--(continued)

(Some terms that describe retrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
2217: (con't)						
Buse	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell slope	Severe: low strength	Slight
Parnell	Severe: excess humus ponding	Severe: shrink-swell ponding	Severe: shrink-swell ponding	Severe: shrink-swell ponding	Severe: low strength shrink-swell ponding	Severe: ponding
2218:						
Brantford	Severe: cutbanks cave	Slight	Slight	Slight	Slight	Moderate: droughty
Vang	Severe: cutbanks cave	Slight	Moderate: wetness	Slight	Moderate: frost action	Slight
2219:						
Hegne	Severe: wetness cutbanks cave	Severe: shrink-swell wetness	Severe: shrink-swell wetness	Severe: shrink-swell wetness	Severe: low strength shrink-swell wetness	Severe: wetness
2220:						
Letcher	Moderate: wetness	Slight	Moderate: wetness	Slight	Moderate: frost action	Severe: excess sodium
Lemert	Severe: cutbanks cave	Slight	Moderate: wetness	Slight	Moderate: frost action	Severe: excess sodium
2221:						
Falsen	Severe: cutbanks cave	Slight	Moderate: wetness	Slight	Slight	Moderate: droughty
2222:						
Peever	Moderate: too clayey	Severe: shrink-swell	Severe: shrink-swell	Severe: shrink-swell	Severe: low strength shrink-swell	Slight
Gwinner	Moderate: too clayey wetness	Moderate: shrink-swell	Moderate: shrink-swell wetness	Moderate: shrink-swell slope	Severe: frost action	Slight
2223:						
Renshaw	Severe: cutbanks cave	Slight	Slight	Slight	Slight	Moderate: droughty
Sioux	Severe: cutbanks cave	Slight	Slight	Slight	Slight	Severe: droughty
2224:						
Serden	Severe: cutbanks cave	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope droughty
Hamar	Severe: wetness cutbanks cave	Severe: wetness	Severe: wetness	Severe: wetness	Moderate: frost action wetness	Moderate: wetness droughty

Table 15.--Building Site Development--(continued)

(Some terms that describe retrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
2225:						
Sioux	Severe: cutbanks cave	Moderate: large stones slope	Moderate: large stones slope	Severe: slope	Moderate: large stones slope	Severe: large stones droughty
2226:						
Stirum	Severe: ponding cutbanks cave	Severe: ponding	Severe: ponding	Severe: ponding	Severe: ponding	Severe: excess sodium wetness
Lemert	Severe: cutbanks cave	Slight	Moderate: wetness	Slight	Moderate: frost action	Severe: excess sodium
2228:						
Aylmer	Severe: wetness cutbanks cave	Moderate: wetness	Severe: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness droughty
Rosewood	Severe: wetness cutbanks cave	Severe: wetness	Severe: wetness	Severe: wetness	Severe: frost action wetness	Severe: wetness
Serden	Severe: cutbanks cave	Slight	Slight	Moderate: slope	Slight	Moderate: droughty

Table 16.—Sanitary Facilities

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." Dashes (—) indicate the map unit component was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
64:					
Arveson	Severe: wetness poor filter	Severe: seepage wetness	Severe: seepage too sandy wetness	Severe: seepage wetness	Poor: seepage too sandy wetness
76:					
Arvilla	Severe: poor filter	Severe: seepage	Severe: seepage too sandy	Severe: seepage	Poor: seepage small stones too sandy
86:					
Aylmer	Severe: wetness poor filter	Severe: seepage wetness	Severe: seepage too sandy wetness	Severe: seepage wetness	Poor: seepage too sandy
Bantry	Severe: wetness poor filter	Severe: seepage wetness	Severe: seepage too sandy wetness	Severe: seepage wetness	Poor: seepage too sandy wetness
118:					
Barnes	Severe: percs slowly	Moderate: seepage slope	Moderate: too clayey	Slight	Fair: too clayey
Buse	Severe: percs slowly	Moderate: seepage slope	Moderate: too clayey	Slight	Fair: too clayey
120:					
Barnes	Severe: percs slowly	Moderate: seepage slope	Moderate: too clayey	Slight	Fair: too clayey
Buse	Severe: percs slowly	Severe: slope	Moderate: too clayey	Slight	Fair: too clayey
154:					
Barnes	Severe: percs slowly	Moderate: seepage slope	Moderate: too clayey	Slight	Fair: too clayey
Svea	Severe: percs slowly wetness	Severe: wetness	Severe: wetness	Severe: wetness	Fair: too clayey wetness
156:					
Barnes	Severe: percs slowly	Moderate: seepage slope	Moderate: too clayey	Slight	Fair: too clayey
Svea	Severe: percs slowly wetness	Severe: wetness	Severe: wetness	Severe: wetness	Fair: too clayey wetness

Table 16.—Sanitary Facilities--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." Dashes (—) indicate the map unit component was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
314:					
Buse	Severe: perċs slowly	Severe: slope	Moderate: slope too clayey	Moderate: slope	Fair: slope too clayey
Barnes	Severe: percs slowly	Moderate: seepage slope	Moderate: too clayey	Slight	Fair: too clayey
450:					
Colvin	Severe: percs slowly wetness	Severe: wetness	Severe: wetness	Severe: wetness	Poor: wetness
493:					
Darnen	Moderate: percs slowly	Moderate: excess humus seepage slope	Moderate: too clayey	Slight	Fair: too clayey
510:					
Divide	Severe: wetness poor filter	Severe: seepage wetness	Severe: seepage too sandy wetness	Severe: seepage wetness	Poor: seepage small stones too sandy
571:					
Embden	Severe: wetness	Severe: seepage wetness	Severe: seepage wetness	Severe: seepage wetness	Fair: too sandy wetness
726:					
Fordville	Severe: poor filter	Severe: seepage	Severe: seepage too sandy	Severe: seepage	Poor: seepage small stones too sandy
772:					
Gardena	Severe: wetness	Severe: seepage wetness	Severe: seepage wetness	Severe: seepage wetness	Fair: wetness
Eckman	Moderate: percs slowly	Moderate: seepage	Slight	Slight	Good
794:					
Glyndon	Severe: wetness	Severe: seepage wetness	Severe: seepage wetness	Severe: seepage wetness	Fair: thin layer wetness
795:					
Glyndon, saline	Severe: wetness poor filter	Severe: seepage wetness	Severe: seepage too sandy wetness	Severe: seepage wetness	Fair: too sandy wetness

Table 16.—Sanitary Facilities--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." Dashes (—) indicate the map unit component was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
852:					
Hamar	Severe: wetness poor filter	Severe: seepage wetness	Severe: seepage too sandy wetness	Severe: seepage wetness	Poor: seepage too sandy wetness
883:					
Hamerly	Severe: percs slowly wetness	Severe: wetness	Severe: wetness	Severe: wetness	Fair: too clayey wetness
Tonka	Severe: percs slowly ponding	Severe: ponding	Severe: too clayey ponding	Severe: ponding	Poor: hard to pack too clayey ponding
Parnell	Severe: percs slowly ponding	Severe: ponding	Severe: too clayey ponding	Severe: ponding	Poor: hard to pack too clayey ponding
939:					
Hecla	Severe: wetness poor filter	Severe: seepage wetness	Severe: seepage too sandy wetness	Severe: seepage wetness	Poor: seepage too sandy
Hamar	Severe: wetness poor filter	Severe: seepage wetness	Severe: seepage too sandy wetness	Severe: seepage wetness	Poor: seepage too sandy wetness
1030:					
Kranzburg	Severe: percs slowly	Moderate: seepage slope	Moderate: too clayey	Slight	Fair: too clayey
Lismore	Severe: percs slowly wetness	Moderate: seepage slope wetness	Severe: wetness	Moderate: wetness	Fair: too clayey
1043:					
La Prairie	Severe: wetness	Moderate: seepage wetness	Severe: wetness	Moderate: flooding wetness	Fair: too clayey
1055:					
LaDelle	Severe: wetness	Moderate: seepage wetness	Moderate: flooding wetness	Moderate: flooding	Poor: hard to pack
1081:					
Lamoure	Severe: percs slowly wetness	Severe: wetness	Severe: wetness	Severe: wetness	Poor: wetness

Table 16.—Sanitary Facilities--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." Dashes (—) indicate the map unit component was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1168:					
Lismore	Severe: perscs slowly, wetness	Moderate: seepage, wetness	Severe: wetness	Moderate: wetness	Fair: too clayey
Kranzburg	Severe: percs slowly	Moderate: seepage	Moderate: too clayey	Slight	Fair: too clayey
1205:					
Maddock	Severe: poor filter	Severe: seepage, slope	Severe: seepage, too sandy	Severe: seepage	Poor: seepage, too sandy
1221:					
Maddock	Severe: poor filter	Severe: seepage	Severe: seepage, too sandy	Severe: seepage	Poor: seepage, too sandy
Hecla	Severe: wetness, poor filter	Severe: seepage, wetness	Severe: seepage, too sandy, wetness	Severe: seepage, wetness	Poor: seepage, too sandy
1269:					
Marysland	Severe: percs slowly, wetness	Severe: seepage, wetness	Severe: seepage, wetness	Severe: seepage, wetness	Poor: seepage, small stones, too sandy
1403:					
Overly	Severe: percs slowly, wetness	Severe: wetness	Severe: wetness	Severe: wetness	Poor: thin layer
1427:					
Parnell	Severe: percs slowly, ponding	Severe: ponding	Severe: too clayey, ponding	Severe: ponding	Poor: hard to pack, too clayey, ponding
1466:					
Pits, gravel and sand	Severe: slope, poor filter	Severe: seepage, slope	Severe: seepage, slope, too sandy	Severe: seepage, slope	Poor: seepage, small stones, too sandy
1472:					
Rauville	Severe: flooding, percs slowly, wetness	Severe: flooding, seepage, wetness	Severe: flooding, seepage, wetness	Severe: flooding, wetness	Poor: hard to pack, too clayey, wetness
1523:					
Renshaw	Severe: poor filter	Severe: seepage	Severe: seepage, too sandy	Severe: seepage	Poor: seepage, small stones, too sandy

Table 16.—Sanitary Facilities--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." Dashes (—) indicate the map unit component was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1560:					
Rifle-------------------	Severe: ponding	Severe: excess humus seepage ponding	Severe: excess humus seepage ponding	Severe: seepage ponding	Poor: excess humus ponding
1577:					
Rosewood---------------	Severe: wetness poor filter	Severe: seepage wetness	Severe: seepage too sandy wetness	Severe: seepage wetness	Poor: seepage too sandy wetness
1648:					
Serden-----------------	Severe: slope poor filter	Severe: seepage slope	Severe: seepage slope too sandy	Severe: seepage slope	Poor: seepage slope too sandy
Duneland---------------	Severe: slope poor filter	Severe: seepage slope	Severe: seepage slope too sandy	Severe: seepage slope	Poor: seepage slope too sandy
1670:					
Ulen-------------------	Severe: wetness poor filter	Severe: seepage wetness	Severe: seepage too sandy wetness	Severe: seepage wetness	Poor: seepage too sandy
Rosewood---------------	Severe: wetness poor filter	Severe: seepage wetness	Severe: seepage too sandy wetness	Severe: seepage wetness	Poor: seepage too sandy wetness
1704:					
Sioux------------------	Severe: poor filter	Severe: seepage	Severe: seepage too sandy	Severe: seepage	Poor: seepage small stones too sandy
Renshaw----------------	Severe: poor filter	Severe: seepage	Severe: seepage too sandy	Severe: seepage	Poor: seepage small stones too sandy
1709:					
Southam----------------	Severe: percs slowly ponding	Severe: ponding	Severe: too clayey ponding	Severe: ponding	Poor: hard to pack too clayey ponding
1772:					
Svea-------------------	Severe: percs slowly wetness	Severe: wetness	Severe: wetness	Severe: wetness	Fair: too clayey wetness

Table 16.—Sanitary Facilities--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." Dashes (—) indicate the map unit component was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1772: (con't)					
Gardena	Severe: wetness	Severe: seepage wetness	Severe: seepage wetness	Severe: seepage wetness	Fair: wetness
1788:					
Swenoda	Severe: percs slowly wetness	Severe: seepage wetness	Moderate: too clayey wetness	Severe: seepage	Fair: too clayey wetness
Barnes	Severe: percs slowly	Moderate: seepage slope	Moderate: too clayey	Slight	Fair: too clayey
1834:					
Tonka	Severe: percs slowly ponding	Severe: ponding	Severe: too clayey ponding	Severe: ponding	Poor: hard to pack too clayey ponding
1842:					
Towner	Severe: percs slowly wetness poor filter	Severe: seepage wetness	Moderate: too clayey wetness	Severe: seepage	Fair: too clayey wetness
1859:					
Ulen	Severe: wetness poor filter	Severe: seepage wetness	Severe: seepage too sandy wetness	Severe: seepage wetness	Poor: seepage too sandy
1871:					
Vallers, saline	Severe: percs slowly wetness	Severe: wetness	Severe: wetness	Severe: wetness	Poor: wetness
1883:					
Vallers	Severe: percs slowly wetness	Severe: wetness	Severe: wetness	Severe: wetness	Poor: wetness
Parnell	Severe: percs slowly ponding	Severe: ponding	Severe: too clayey ponding	Severe: ponding	Poor: hard to pack too clayey ponding
1935:					
Venlo	Severe: ponding poor filter	Severe: seepage ponding	Severe: seepage too sandy ponding	Severe: seepage ponding	Poor: seepage too sandy ponding
1953:					
Wahpeton	Severe: flooding percs slowly	Severe: flooding	Severe: flooding too clayey	Severe: flooding	Poor: hard to pack too clayey

Table 16.--Sanitary Facilities--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." Dashes (--) indicate the map unit component was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1978:					
Water	--	--	--	--	--
2049:					
Wyndmere	Severe: wetness poor filter	Severe: seepage wetness	Severe: seepage too sandy wetness	Severe: seepage wetness	Poor: too sandy
2091:					
Zell	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Poor: slope
2206:					
Barnes	Severe: percs slowly	Moderate: seepage slope	Moderate: too clayey	Slight	Fair: too clayey
Sioux	Severe: poor filter	Severe: seepage	Severe: seepage too sandy	Severe: seepage	Poor: seepage small stones too sandy
2207:					
Bearden	Severe: percs slowly wetness	Severe: seepage wetness	Severe: seepage too clayey wetness	Severe: wetness	Poor: hard to pack too clayey
2208:					
Brantford	Severe: poor filter	Severe: seepage	Severe: seepage too sandy	Severe: seepage	Poor: seepage small stones too sandy
Coe	Severe: poor filter	Severe: seepage	Severe: seepage too sandy	Severe: seepage	Poor: seepage small stones too sandy
2209:					
Buse	Severe: percs slowly	Severe: slope	Moderate: slope too clayey	Moderate: slope	Fair: slope too clayey
Barnes	Severe: percs slowly	Moderate: seepage slope	Moderate: too clayey	Slight	Fair: too clayey
2210:					
Cathay	Severe: percs slowly wetness	Severe: large stones wetness	Severe: excess sodium large stones wetness	Severe: wetness	Poor: excess sodium

Table 16.--Sanitary Facilities--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." Dashes (--) indicate the map unit component was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
2210: (con't)					
Larson	Severe: percs slowly wetness	Severe: large stones wetness	Severe: excess sodium large stones wetness	Severe: wetness	Poor: excess sodium large stones
2211:					
Eckman	Moderate: percs slowly	Moderate: seepage slope	Slight	Slight	Good
Gardena	Severe: wetness	Severe: seepage wetness	Severe: seepage wetness	Severe: seepage wetness	Fair: wetness
2212:					
Eckman	Moderate: percs slowly	Moderate: seepage slope	Slight	Slight	Good
Zell	Moderate: percs slowly	Severe: slope	Slight	Slight	Good
2213:					
Eckman	Moderate: percs slowly	Severe: slope	Slight	Slight	Good
Zell	Moderate: percs slowly	Severe: slope	Slight	Slight	Good
2214:					
Exline	Severe: percs slowly wetness	Slight	Severe: too clayey too sandy wetness	Severe: wetness	Poor: excess sodium hard to pack too clayey
2215:					
Fairdale	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Fair: too clayey wetness
2216:					
Gwinner	Severe: percs slowly wetness	Severe: wetness	Severe: wetness	Severe: wetness	Fair: too clayey wetness
Peever	Severe: percs slowly	Slight	Severe: too clayey	Slight	Poor: hard to pack too clayey
Parnell	Severe: percs slowly ponding	Severe: ponding	Severe: too clayey ponding	Severe: ponding	Poor: hard to pack too clayey ponding

Table 16.—Sanitary Facilities--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." Dashes (—) indicate the map unit component was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
2217:					
Hamerly	Severe: perc slowly wetness	Severe: wetness	Severe: wetness	Severe: wetness	Fair: too clayey wetness
Buse	Severe: percs slowly	Moderate: seepage slope	Moderate: too clayey	Slight	Fair: too clayey
Parnell	Severe: percs slowly ponding	Severe: ponding	Severe: too clayey ponding	Severe: ponding	Poor: hard to pack too clayey ponding
2218:					
Brantford	Severe: poor filter	Severe: seepage	Severe: seepage too sandy	Severe: seepage	Poor: seepage small stones too sandy
Vang	Severe: poor filter	Severe: seepage	Severe: seepage too sandy wetness	Severe: seepage	Poor: small stones too sandy
2219:					
Hegne	Severe: percs slowly wetness	Slight	Severe: too clayey wetness	Severe: wetness	Poor: hard to pack too clayey wetness
2220:					
Letcher	Severe: wetness	Severe: seepage	Severe: excess sodium seepage	Severe: seepage	Poor: excess sodium
Lemert	Severe: percs slowly wetness poor filter	Severe: seepage wetness	Severe: excess sodium too sandy wetness	Severe: seepage wetness	Poor: excess sodium seepage too sandy
2221:					
Falsen	Severe: wetness poor filter	Severe: seepage wetness	Severe: seepage too sandy wetness	Severe: seepage wetness	Poor: seepage too sandy
2222:					
Peever	Severe: percs slowly	Moderate: slope	Severe: too clayey	Slight	Poor: hard to pack too clayey
Gwinner	Severe: percs slowly wetness	Severe: wetness	Severe: wetness	Severe: wetness	Fair: too clayey wetness

Table 16.—Sanitary Facilities--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "severe." Dashes (—) indicate the map unit component was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
2223:					
Renshaw----------------	Severe: poor filter	Severe: seepage	Severe: seepage too sandy	Severe: seepage	Poor: seepage small stones too sandy
Sioux-----------------	Severe: poor filter	Severe: seepage	Severe: seepage too sandy	Severe: seepage	Poor: seepage small stones too sandy
2224:					
Serden----------------	Severe: poor filter	Severe: seepage slope	Severe: seepage too sandy	Severe: seepage	Poor: seepage too sandy
Hamar-----------------	Severe: wetness poor filter	Severe: seepage wetness	Severe: seepage too sandy wetness	Severe: seepage wetness	Poor: seepage too sandy wetness
2225:					
Sioux-----------------	Severe: poor filter	Severe: large stones seepage slope	Severe: seepage too sandy	Severe: seepage	Poor: seepage small stones too sandy
2226:					
Stirum----------------	Severe: ponding poor filter	Severe: seepage ponding	Severe: seepage ponding	Severe: seepage ponding	Poor: excess sodium ponding
Lemert----------------	Severe: percs slowly wetness poor filter	Severe: seepage wetness	Severe: excess sodium too sandy wetness	Severe: seepage wetness	Poor: excess sodium seepage too sandy
2228:					
Aylmer----------------	Severe: wetness poor filter	Severe: seepage wetness	Severe: seepage too sandy wetness	Severe: seepage wetness	Poor: seepage too sandy
Rosewood--------------	Severe: wetness poor filter	Severe: seepage wetness	Severe: seepage too sandy wetness	Severe: seepage wetness	Poor: seepage too sandy wetness
Serden-----------------	Severe: poor filter	Severe: seepage	Severe: seepage too sandy	Severe: seepage	Poor: seepage too sandy

Table 17.—Construction Materials

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," or other terms. Dashes (—) indicate the map unit component was not rated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
64:				
Arveson	Poor: wetness	Probable	Improbable: too sandy	Poor: wetness
76:				
Arvilla	Good	Probable	Probable	Poor: area reclaim, small stones, too sandy
86:				
Aylmer	Fair: wetness	Probable	Improbable: too sandy	Poor: too sandy
Bantry	Fair: wetness	Probable	Improbable: too sandy	Poor: too sandy
118:				
Barnes	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: small stones
Buse	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: small stones, too clayey
120:				
Barnes	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: small stones
Buse	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: small stones, too clayey
154:				
Barnes	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: small stones
Svea	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: small stones
156:				
Barnes	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: small stones
Svea	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: small stones
314:				
Buse	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: slope, small stones, too clayey
Barnes	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: small stones

Table 17.--Construction Materials--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," or other terms. Dashes (--) indicate the map unit component was not rated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
450:				
Colvin	Poor: low strength wetness	Improbable: excess fines	Improbable: excess fines	Poor: wetness
493:				
Darnen	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Good
510:				
Divide	Fair: wetness	Probable	Probable	Poor: area reclaim small stones too sandy
571:				
Embden	Good	Improbable: excess fines	Improbable: excess fines	Good
726:				
Fordville	Good	Probable	Probable	Poor: area reclaim small stones too sandy
772:				
Gardena	Good	Improbable: excess fines	Improbable: excess fines	Good
Eckman	Good	Improbable: excess fines	Improbable: excess fines	Good
794:				
Glyndon	Fair: wetness	Improbable: excess fines	Improbable: excess fines	Fair: thin layer
795:				
Glyndon, saline	Fair: wetness	Improbable: excess fines	Improbable: excess fines	Poor: excess salt too sandy
852:				
Hamar	Fair: wetness	Probable	Improbable: too sandy	Poor: too sandy
883:				
Hamerly	Fair: low strength shrink-swell wetness	Improbable: excess fines	Improbable: excess fines	Fair: small stones
Tonka	Poor: low strength wetness	Improbable: excess fines	Improbable: excess fines	Poor: too clayey wetness
Parnell	Poor: low strength shrink-swell wetness	Improbable: excess fines	Improbable: excess fines	Poor: wetness

Table 17.--Construction Materials--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," or other terms. Dashes (--) indicate the map unit component was not rated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
939:				
Hecla	Good	Probable	Improbable: too sandy	Poor: too sandy
Hamar	Fair: wetness	Probable	Improbable: too sandy	Poor: too sandy
1030:				
Kranzburg	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Good
Lismore	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Good
1043:				
La Prairie	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey
1055:				
LaDelle	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Good
1081:				
Lamoure	Poor: low strength wetness	Improbable: excess fines	Improbable: excess fines	Poor: wetness
1168:				
Lismore	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Good
Kranzburg	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Good
1205:				
Maddock	Good	Probable	Improbable: too sandy	Poor: too sandy
1221:				
Maddock	Good	Probable	Improbable: too sandy	Poor: too sandy
Hecla	Good	Probable	Improbable: too sandy	Poor: too sandy
1269:				
Marysland	Poor: wetness	Probable	Probable	Poor: area reclaim small stones wetness
1403:				
Overly	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: thin layer

Table 17.--Construction Materials--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," or other terms. Dashes (--) indicate the map unit component was not rated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1427:				
Parnell	Poor: low strength shrink-swell wetness	Improbable: excess fines	Improbable: excess fines	Poor: wetness
1466:				
Pits, gravel and sand	Poor: slope	Probable	Probable	Poor: area reclaim small stones too sandy
1472:				
Rauville	Poor: wetness	Improbable: excess fines	Improbable: excess fines	Poor: wetness
1523:				
Renshaw	Good	Probable	Probable	Poor: area reclaim small stones too sandy
1560:				
Rifle	Poor: low strength wetness	Improbable: excess humus	Improbable: excess humus	Poor: excess humus wetness
1577:				
Rosewood	Poor: wetness	Probable	Improbable: too sandy	Poor: too sandy wetness
1648:				
Serden	Fair: slope	Probable	Improbable: too sandy	Poor: slope too sandy
Duneland	Fair: slope	Probable	Improbable: too sandy	Poor: slope too sandy
1670:				
Ulen	Fair: wetness	Probable	Improbable: too sandy	Poor: too sandy
Rosewood	Poor: wetness	Probable	Improbable: too sandy	Poor: too sandy wetness
1704:				
Sioux	Good	Probable	Probable	Poor: area reclaim small stones too sandy
Renshaw	Good	Probable	Probable	Poor: area reclaim small stones too sandy

Table 17.--Construction Materials--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," or other terms. Dashes (-) indicate the map unit component was not rated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1709:				
Southam	Poor: low strength shrink-swell wetness	Improbable: excess fines	Improbable: excess fines	Poor: too clayey wetness
1772:				
Svea	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: small stones
Gardena	Good	Improbable: excess fines	Improbable: excess fines	Good
1788:				
Swenoda	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: small stones
Barnes	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: small stones
1834:				
Tonka	Poor: low strength wetness	Improbable: excess fines	Improbable: excess fines	Poor: too clayey wetness
1842:				
Towner	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Poor: too sandy
1859:				
Ulen	Fair: wetness	Probable	Improbable: too sandy	Poor: too sandy
1871:				
Vallers, saline	Poor: low strength wetness	Improbable: excess fines	Improbable: excess fines	Poor: excess salt wetness
1883:				
Vallers	Fair: low strength wetness	Improbable: excess fines	Improbable: excess fines	Fair: small stones
Parnell	Poor: low strength shrink-swell wetness	Improbable: excess fines	Improbable: excess fines	Poor: wetness
1935:				
Venlo	Poor: wetness	Probable	Improbable: too sandy	Poor: too sandy wetness
1953:				
Wahpeton	Poor: low strength shrink-swell	Improbable: excess fines	Improbable: excess fines	Poor: too clayey

Table 17.--Construction Materials--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," or other terms. Dashes (--) indicate the map unit component was not rated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1978:				
Water	--	--	--	--
2049:				
Wyndmere	Fair: wetness	Improbable: excess fines	Improbable: excess fines	Fair: thin layer
2091:				
Zell	Fair: slope	Improbable: excess fines	Improbable: excess fines	Poor: slope
2206:				
Barnes	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: small stones
Sioux	Good	Probable	Probable	Poor: area reclaim small stones too sandy
2207:				
Bearden	Fair: wetness	Probable	Improbable: too sandy	Fair: thin layer
2208:				
Brantford	Good	Probable	Probable	Poor: area reclaim small stones too sandy
Coe	Good	Probable	Probable	Poor: area reclaim small stones too sandy
2209:				
Buse	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: slope small stones too clayey
Barnes	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: small stones
2210:				
Cathay	Fair: large stones low strength shrink-swell	Improbable: excess fines	Improbable: excess fines	Poor: area reclaim excess sodium large stones
Larson	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Poor: area reclaim excess sodium large stones
2211:				
Eckman	Good	Improbable: excess fines	Improbable: excess fines	Good

Table 17.--Construction Materials--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," or other terms. Dashes (--) indicate the map unit component was not rated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
2211: (con't)				
Gardena	Good	Improbable: excess fines	Improbable: excess fines	Good
2212:				
Eckman	Good	Improbable: excess fines	Improbable: excess fines	Good
Zell	Good	Improbable: excess fines	Improbable: excess fines	Good
2213:				
Eckman	Good	Improbable: excess fines	Improbable: excess fines	Good
Zell	Good	Improbable: excess fines	Improbable: excess fines	Good
2214:				
Exline	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Poor: excess sodium excess salt too clayey
2215:				
Fairdale	Fair: low strength shrink-swell	Improbable: excess fines	Improbable: excess fines	Good
2216:				
Gwinner	Fair: low strength shrink-swell	Improbable: excess fines	Improbable: excess fines	Poor: thin layer
Peever	Poor: low strength shrink-swell	Improbable: excess fines	Improbable: excess fines	Poor: too clayey
Parnell	Poor: low strength shrink-swell wetness	Improbable: excess fines	Improbable: excess fines	Poor: wetness
2217:				
Hamerly	Fair: low strength shrink-swell wetness	Improbable: excess fines	Improbable: excess fines	Fair: small stones
Buse	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: small stones too clayey
Parnell	Poor: low strength shrink-swell wetness	Improbable: excess fines	Improbable: excess fines	Poor: wetness

Table 17.--Construction Materials--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," or other terms. Dashes (-) indicate the map unit component was not rated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
2218:				
Brantford	Good	Probable	Probable	Poor: area reclaim small stones too sandy
Vang	Good	Improbable: excess fines	Improbable: excess fines	Poor: area reclaim small stones
2219:				
Hegne	Poor: low strength shrink-swell wetness	Improbable: excess fines	Improbable: excess fines	Poor: too clayey wetness
2220:				
Letcher	Good	Improbable: excess fines	Improbable: excess fines	Poor: excess sodium
Lemert	Good	Improbable: thin layer	Improbable: too sandy	Poor: excess sodium too sandy
2221:				
Falsen	Good	Probable	Improbable: too sandy	Poor: thin layer
2222:				
Peever	Poor: low strength shrink-swell	Improbable: excess fines	Improbable: excess fines	Poor: too clayey
Gwinner	Fair: low strength shrink-swell	Improbable: excess fines	Improbable: excess fines	Poor: thin layer
2223:				
Renshaw	Good	Probable	Probable	Poor: area reclaim small stones too sandy
Sioux	Good	Probable	Probable	Poor: area reclaim small stones too sandy
2224:				
Serden	Good	Probable	Improbable: too sandy	Poor: too sandy
Hamar	Fair: wetness	Probable	Improbable: too sandy	Poor: too sandy

Table 17.--Construction Materials--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," or other terms. Dashes (--) indicate the map unit component was not rated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
2225:				
Sioux-------------------	Fair: large stones	Probable	Probable	Poor: area reclaim small stones too sandy
2226:				
Stirum------------------	Poor: wetness	Improbable: excess fines	Improbable: excess fines	Poor: excess sodium excess salt wetness
Lemert------------------	Good	Improbable: thin layer	Improbable: too sandy	Poor: excess sodium too sandy
2228:				
Aylmer------------------	Fair: wetness	Probable	Improbable: too sandy	Poor: too sandy
Rosewood----------------	Poor: wetness	Probable	Improbable: too sandy	Poor: too sandy wetness
Serden------------------	Good	Probable	Improbable: too sandy	Poor: too sandy

Table 18.--Water Management

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Dashes (--) indicate that the map unit component was not evaluated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
64:							
Arveson	Severe: seepage	Severe: seepage piping wetness	Severe: cutbanks cave	Limitation: frost action cutbanks cave	Limitation: wetness soil blowing	Limitation: too sandy wetness soil blowing	Limitation: wetness
76:							
Arvilla	Severe: seepage	Severe: seepage piping	Severe: no water	Limitation: deep to water	Limitation: slope soil blowing droughty	Limitation: too sandy soil blowing	Limitation: droughty
86:							
Aylmer	Severe: seepage	Severe: seepage piping wetness	Severe: cutbanks cave	Limitation: slope cutbanks cave	Limitation: slope wetness droughty	Limitation: too sandy wetness soil blowing	Limitation: droughty
Bantry	Severe: seepage	Severe: seepage piping wetness	Severe: cutbanks cave	Limitation: cutbanks cave	Limitation: wetness droughty	Limitation: too sandy wetness soil blowing	Limitation: wetness droughty
118:							
Barnes	Moderate: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily
Buse	Moderate: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily
120:							
Barnes	Moderate: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily
Buse	Moderate: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily
154:							
Barnes	Moderate: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily
Svea	Moderate: seepage slope	Severe: piping	Severe: slow refill	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily
156:							
Barnes	Moderate: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily
Svea	Moderate: seepage slope	Severe: piping	Severe: slow refill	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily

Table 18.—Water Management--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Dashes (—) indicate that the map unit component was not evaluated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Limitations for— Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting— Drainage	Irrigation	Terraces and diversions	Grassed waterways
314:							
Buse	Severe: slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily slope	Limitation: erodes easily slope
Barnes	Moderate: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily
450:							
Colvin	Moderate: seepage	Severe: piping wetness	Severe: slow refill	Limitation: frost action	Limitation: wetness	Limitation: erodes easily wetness	Limitation: erodes easily wetness
493:							
Darnen	Moderate: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily
510:							
Divide	Severe: seepage	Severe: seepage piping wetness	Severe: slow refill cutbanks cave	Limitation: cutbanks cave	Limitation: wetness	Limitation: too sandy wetness	Favorable
571:							
Embden	Severe: seepage	Severe: seepage piping	Severe: cutbanks cave	Limitation: deep to water	Limitation: soil blowing	Limitation: soil blowing	Favorable
726:							
Fordville	Severe: seepage	Severe: seepage	Severe: no water	Limitation: deep to water	Limitation: rooting depth	Limitation: too sandy	Limitation: rooting depth
772:							
Gardena	Severe: seepage	Severe: piping	Moderate: slow refill deep to water	Limitation: deep to water	Favorable	Limitation: erodes easily	Limitation: erodes easily
Eckman	Moderate: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Favorable	Limitation: erodes easily	Limitation: erodes easily
794:							
Glyndon	Severe: seepage	Severe: piping	Severe: cutbanks cave	Limitation: frost action	Limitation: wetness	Limitation: wetness	Favorable
795:							
Glyndon, saline	Severe: seepage	Severe: piping wetness	Severe: cutbanks cave	Limitation: excess salt frost action cutbanks cave	Limitation: excess salt wetness	Limitation: wetness	Limitation: excess salt
852:							
Hamar	Severe: seepage	Severe: seepage piping wetness	Severe: cutbanks cave	Limitation: cutbanks cave	Limitation: fast intake wetness droughty	Limitation: too sandy wetness soil blowing	Limitation: wetness droughty

Table 18.--Water Management--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Dashes (-) indicate that the map unit component was not evaluated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
883:							
Hamerly	Moderate: seepage	Severe: piping wetness	Severe: slow refill	Limitation: frost action	Limitation: wetness	Limitation: erodes easily wetness	Limitation: erodes easily
Tonka	Moderate: seepage	Severe: ponding	Severe: slow refill	Limitation: frost action percs slowly ponding	Limitation: erodes easily percs slowly ponding	Limitation: erodes easily percs slowly ponding	Limitation: erodes easily percs slowly wetness
Parnell	Slight	Severe: hard to pack ponding	Severe: slow refill	Limitation: frost action percs slowly ponding	Limitation: percs slowly ponding	Limitation: erodes easily percs slowly ponding	Limitation: erodes easily percs slowly wetness
939:							
Hecla	Severe: seepage	Severe: seepage piping	Severe: cutbanks cave	Limitation: deep to water	Limitation: fast intake soil blowing droughty	Limitation: too sandy soil blowing	Limitation: droughty
Hamar	Severe: seepage	Severe: seepage piping wetness	Severe: cutbanks cave	Limitation: cutbanks cave	Limitation: fast intake wetness droughty	Limitation: too sandy wetness soil blowing	Limitation: wetness droughty
1030:							
Kranzburg	Moderate: seepage slope	Moderate: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily
Lismore	Moderate: slope	Moderate: piping wetness	Severe: slow refill	Limitation: deep to water	Limitation: slope	Favorable	Favorable
1043:							
La Prairie	Moderate: seepage	Severe: piping	Moderate: slow refill deep to water	Limitation: deep to water	Favorable	Favorable	Favorable
1055:							
LaDelle	Moderate: seepage	Severe: hard to pack	Severe: no water	Limitation: deep to water	Favorable	Favorable	Favorable
1081:							
Lamoure	Moderate: seepage	Severe: wetness	Severe: slow refill	Limitation: frost action	Limitation: wetness	Limitation: erodes easily wetness	Limitation: erodes easily wetness
1168:							
Lismore	Slight	Moderate: piping wetness	Severe: slow refill	Limitation: deep to water	Favorable	Favorable	Favorable
Kranzburg	Moderate: seepage	Moderate: piping	Severe: no water	Limitation: deep to water	Favorable	Limitation: erodes easily	Limitation: erodes easily

Table 18.--Water Management--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Dashes (--) indicate that the map unit component was not evaluated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
1205:							
Maddock	Severe: seepage slope	Severe: seepage piping	Severe: no water	Limitation: deep to water	Limitation: fast intake slope droughty	Limitation: slope too sandy soil blowing	Limitation: slope droughty
1221:							
Maddock	Severe: seepage	Severe: seepage piping	Severe: no water	Limitation: deep to water	Limitation: fast intake slope droughty	Limitation: too sandy soil blowing	Limitation: droughty
Hecla	Severe: seepage	Severe: seepage piping	Severe: cutbanks cave	Limitation: deep to water	Limitation: fast intake soil blowing droughty	Limitation: too sandy soil blowing	Limitation: droughty
1269:							
Marysland	Severe: seepage	Severe: seepage wetness	Severe: slow refill cutbanks cave	Limitation: frost action cutbanks cave	Limitation: wetness	Limitation: too sandy wetness	Limitation: wetness
1403:							
Overly	Slight	Severe: piping	Severe: slow refill	Limitation: deep to water	Limitation: erodes easily percs slowly	Limitation: erodes easily	Limitation: erodes easily percs slowly
1427:							
Parnell	Slight	Severe: hard to pack ponding	Severe: slow refill	Limitation: frost action percs slowly ponding	Limitation: percs slowly ponding	Limitation: erodes easily percs slowly ponding	Limitation: erodes easily percs slowly wetness
1466:							
Pits, gravel and sand	Severe: seepage slope	Severe: seepage	Severe: no water	Limitation: deep to water	Limitation: fast intake slope droughty	Limitation: slope too sandy	Limitation: slope droughty
1472:							
Rauville	Severe: seepage	Severe: hard to pack wetness	Severe: slow refill cutbanks cave	Limitation: flooding frost action	Limitation: flooding wetness	Limitation: wetness	Limitation: wetness
1523:							
Renshaw	Severe: seepage	Severe: seepage	Severe: no water	Limitation: deep to water	Limitation: droughty	Limitation: too sandy	Limitation: droughty
1560:							
Rifle	Severe: seepage	Severe: excess humus ponding	Moderate: slow refill	Limitation: frost action ponding	Limitation: ponding	Limitation: ponding	Limitation: wetness
1577:							
Rosewood	Severe: seepage	Severe: seepage piping wetness	Severe: cutbanks cave	Limitation: frost action cutbanks cave	Limitation: wetness droughty	Limitation: too sandy wetness soil blowing	Limitation: wetness droughty

Table 18.--Water Management--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Dashes (--) indicate that the map unit component was not evaluated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
1648:							
Serden	Severe: seepage slope	Severe: seepage piping	Severe: no water	Limitation: deep to water	Limitation: fast intake slope droughty	Limitation: slope too sandy soil blowing	Limitation: slope droughty
Duneland	Severe: seepage slope	Severe: seepage piping	Severe: no water	Limitation: deep to water	Limitation: fast intake slope droughty	Limitation: slope too sandy soil blowing	Limitation: slope droughty
1670:							
Ulen	Severe: seepage	Severe: seepage piping	Severe: cutbanks cave	Limitation: cutbanks cave	Limitation: wetness droughty	Limitation: too sandy wetness soil blowing	Limitation: droughty
Rosewood	Severe: seepage	Severe: seepage piping wetness	Severe: cutbanks cave	Limitation: frost action cutbanks cave	Limitation: wetness droughty	Limitation: too sandy wetness soil blowing	Limitation: wetness droughty
1704:							
Sioux	Severe: seepage	Severe: seepage	Severe: no water	Limitation: deep to water	Limitation: slope droughty	Limitation: too sandy soil blowing	Limitation: droughty
Renshaw	Severe: seepage	Severe: seepage	Severe: no water	Limitation: deep to water	Limitation: slope droughty	Limitation: too sandy	Limitation: droughty
1709:							
Southam	Slight	Severe: thin layer ponding	Severe: slow refill	Limitation: frost action percs slowly ponding	Limitation: percs slowly ponding	Limitation: erodes easily percs slowly ponding	Limitation: erodes easily excess salt wetness
1772:							
Svea	Moderate: seepage slope	Severe: piping	Severe: slow refill	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily
Gardena	Severe: seepage	Severe: piping	Moderate: slow refill deep to water	Limitation: deep to water	Favorable	Limitation: erodes easily	Limitation: erodes easily
1788:							
Swenoda	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: soil blowing	Limitation: erodes easily soil blowing	Limitation: erodes easily
Barnes	Moderate: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily

Table 18.--Water Management--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Dashes (--) indicate that the map unit component was not evaluated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
1834:							
Tonka	Moderate: seepage	Severe: ponding	Severe: slow refill	Limitation: frost action, percs slowly, ponding	Limitation: erodes easily, percs slowly, ponding	Limitation: erodes easily, percs slowly, ponding	Limitation: erodes easily, percs slowly, wetness
1842:							
Towner	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: fast intake, slope, droughty	Limitation: erodes easily, soil blowing	Limitation: erodes easily, droughty
1859:							
Ulen	Severe: seepage	Severe: seepage, piping	Severe: cutbanks cave	Limitation: cutbanks cave	Limitation: wetness, droughty	Limitation: too sandy, wetness, soil blowing	Limitation: droughty
1871:							
Vallers, saline	Moderate: seepage	Severe: piping, wetness	Severe: slow refill	Limitation: excess salt, frost action	Limitation: excess salt, wetness	Limitation: erodes easily, wetness	Limitation: erodes easily, excess salt, wetness
1883:							
Vallers	Slight	Severe: piping, wetness	Severe: slow refill	Limitation: frost action	Limitation: wetness	Limitation: wetness	Limitation: wetness
Parnell	Slight	Severe: hard to pack, ponding	Severe: slow refill	Limitation: frost action, percs slowly, ponding	Limitation: percs slowly, ponding	Limitation: erodes easily, percs slowly, ponding	Limitation: erodes easily, percs slowly, wetness
1935:							
Venlo	Severe: seepage	Severe: seepage, piping, ponding	Severe: cutbanks cave	Limitation: ponding, cutbanks cave	Limitation: ponding, droughty	Limitation: too sandy, soil blowing, ponding	Limitation: wetness, droughty
1953:							
Wahpeton	Moderate: seepage	Severe: hard to pack	Severe: no water	Limitation: deep to water	Limitation: flooding, slow intake	Favorable	Favorable
1978:							
Water	--	--	--	--	--	--	--
2049:							
Wyndmere	Severe: seepage	Severe: piping, wetness	Severe: cutbanks cave	Limitation: frost action, cutbanks cave	Limitation: wetness	Limitation: too sandy, wetness	Favorable
2091:							
Zell	Severe: slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily, slope	Limitation: erodes easily, slope

Table 18.--Water Management--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Dashes (--) indicate that the map unit component was not evaluated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
2206:							
Barnes	Moderate: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily
Sioux	Severe: seepage	Severe: seepage	Severe: no water	Limitation: deep to water	Limitation: slope droughty	Limitation: too sandy soil blowing	Limitation: droughty
2207:							
Bearden	Severe: seepage	Moderate: hard to pack piping thin layer	Severe: slow refill cutbanks cave	Limitation: frost action percs slowly	Limitation: percs slowly wetness	Limitation: erodes easily percs slowly wetness	Limitation: erodes easily percs slowly
2208:							
Brantford	Severe: seepage	Severe: seepage	Severe: no water	Limitation: deep to water	Limitation: droughty	Limitation: large stones too sandy	Limitation: large stones droughty
Coe	Severe: seepage	Severe: seepage	Severe: no water	Limitation: deep to water	Limitation: slope soil blowing droughty	Limitation: large stones too sandy	Limitation: large stones droughty
2209:							
Buse	Severe: slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily slope	Limitation: erodes easily slope
Barnes	Moderate: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily
2210:							
Cathay	Moderate: seepage	Severe: excess sodium large stones piping	Severe: slow refill	Limitation: deep to water	Limitation: excess sodium large stones percs slowly	Limitation: large stones	Limitation: excess sodium large stones percs slowly
Larson	Moderate: seepage	Severe: excess sodium large stones piping	Severe: slow refill	Limitation: deep to water	Limitation: excess sodium large stones percs slowly	Limitation: large stones	Limitation: excess sodium large stones percs slowly
2211:							
Eckman	Moderate: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily
Gardena	Severe: seepage	Severe: piping	Moderate: slow refill deep to water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily
2212:							
Eckman	Moderate: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily

Table 18.—Water Management--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Dashes (—) indicate that the map unit component was not evaluated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Limitations for— Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting— Drainage	Irrigation	Terraces and diversions	Grassed waterways
2212: (con't)							
Zell	Moderate: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily
2213:							
Eckman	Moderate: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily
Zell	Moderate: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily
2214:							
Exline	Slight	Severe: excess sodium wetness	Severe: slow refill cutbanks cave	Limitation: excess salt percs slowly cutbanks cave	Limitation: percs slowly wetness	Limitation: erodes easily percs slowly wetness	Limitation: erodes easily excess sodium percs slowly
2215:							
Fairdale	Moderate: seepage slope	Severe: piping	Moderate: slow refill deep to water	Limitation: deep to water	Limitation: slope	Favorable	Favorable
2216:							
Gwinner	Slight	Severe: piping	Severe: slow refill	Limitation: deep to water	Limitation: percs slowly	Favorable	Limitation: percs slowly
Peever	Slight	Severe: hard to pack	Severe: no water	Limitation: deep to water	Limitation: percs slowly	Limitation: erodes easily percs slowly	Limitation: erodes easily percs slowly
Parnell	Slight	Severe: hard to pack ponding	Severe: slow refill	Limitation: frost action percs slowly ponding	Limitation: percs slowly ponding	Limitation: erodes easily percs slowly ponding	Limitation: erodes easily percs slowly wetness
2217:							
Hamerly	Moderate: seepage	Severe: piping wetness	Severe: slow refill	Limitation: frost action	Limitation: wetness	Limitation: erodes easily wetness	Limitation: erodes easily
Buse	Moderate: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily
Parnell	Slight	Severe: hard to pack ponding	Severe: slow refill	Limitation: frost action percs slowly ponding	Limitation: percs slowly ponding	Limitation: erodes easily percs slowly ponding	Limitation: erodes easily percs slowly wetness
2218:							
Brantford	Severe: seepage	Severe: seepage	Severe: no water	Limitation: deep to water	Limitation: droughty	Limitation: large stones too sandy	Limitation: large stones droughty

Table 18.--Water Management--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Dashes (--) indicate that the map unit component was not evaluated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
2218: (con't)							
Vang	Severe: seepage	Severe: seepage	Severe: cutbanks cave	Limitation: deep to water	Limitation: rooting depth	Limitation: too sandy	Limitation: rooting depth
2219:							
Hegne	Slight	Severe: hard to pack wetness	Severe: slow refill	Limitation: frost action percs slowly	Limitation: percs slowly wetness	Limitation: percs slowly wetness	Limitation: percs slowly wetness
2220:							
Letcher	Severe: seepage	Severe: excess sodium piping	Severe: no water	Limitation: deep to water	Limitation: percs slowly	Limitation: soil blowing	Limitation: excess sodium percs slowly
Lemert	Severe: seepage	Severe: excess sodium seepage piping	Severe: slow refill cutbanks cave	Limitation: deep to water	Limitation: percs slowly soil blowing droughty	Limitation: too sandy soil blowing	Limitation: excess sodium excess salt droughty
2221:							
Falsen	Severe: seepage	Severe: seepage piping	Severe: cutbanks cave	Limitation: deep to water	Limitation: fast intake soil blowing droughty	Limitation: too sandy soil blowing	Limitation: droughty
2222:							
Peever	Moderate: slope	Severe: hard to pack	Severe: no water	Limitation: deep to water	Limitation: percs slowly slope	Limitation: erodes easily percs slowly	Limitation: erodes easily percs slowly
Gwinner	Moderate: slope	Severe: piping	Severe: slow refill	Limitation: deep to water	Limitation: percs slowly slope	Favorable	Limitation: percs slowly
2223:							
Renshaw	Severe: seepage	Severe: seepage	Severe: no water	Limitation: deep to water	Limitation: slope droughty	Limitation: too sandy	Limitation: droughty
Sioux	Severe: seepage	Severe: seepage	Severe: no water	Limitation: deep to water	Limitation: slope droughty	Limitation: too sandy soil blowing	Limitation: droughty
2224:							
Serden	Severe: seepage slope	Severe: seepage piping	Severe: no water	Limitation: deep to water	Limitation: fast intake slope droughty	Limitation: slope too sandy soil blowing	Limitation: slope droughty
Hamar	Severe: seepage	Severe: seepage piping wetness	Severe: cutbanks cave	Limitation: cutbanks cave	Limitation: fast intake wetness droughty	Limitation: too sandy wetness soil blowing	Limitation: wetness droughty

Table 18.--Water Management--(continued)

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Dashes (--) indicate that the map unit component was not evaluated.) The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
2225:							
Sioux	Severe: seepage slope	Severe: seepage	Severe: no water	Limitation: deep to water	Limitation: large stones slope droughty	Limitation: large stones slope too sandy	Limitation: large stones slope droughty
2226:							
Stirum	Severe: seepage	Severe: seepage piping ponding	Severe: slow refill cutbanks cave	Limitation: ponding cutbanks cave	Limitation: ponding droughty	Limitation: too sandy soil blowing ponding	Limitation: excess sodium excess salt wetness
Lemert	Severe: seepage	Severe: excess sodium seepage piping	Severe: slow refill cutbanks cave	Limitation: deep to water	Limitation: percs slowly soil blowing droughty	Limitation: too sandy soil blowing	Limitation: excess sodium excess salt droughty
2228:							
Aylmer	Severe: seepage	Severe: seepage piping wetness	Severe: cutbanks cave	Limitation: slope cutbanks cave	Limitation: slope wetness droughty	Limitation: too sandy wetness soil blowing	Limitation: droughty
Rosewood	Severe: seepage	Severe: seepage piping wetness	Severe: cutbanks cave	Limitation: frost action cutbanks cave	Limitation: wetness droughty	Limitation: too sandy wetness soil blowing	Limitation: wetness droughty
Serden	Severe: seepage	Severe: seepage piping	Severe: no water	Limitation: deep to water	Limitation: fast intake slope droughty	Limitation: too sandy soil blowing	Limitation: droughty

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and estimates of soil and water features listed in tables are explained on the following pages.

Soil properties are determined by or estimated from the field examination of soils and laboratory testing. During the survey, many shallow borings are made and examined to identify and classify soils and delineate them on soil maps. Samples are taken from some typical soils and tested in the laboratory to determine physical and chemical soil properties. Standard laboratory procedures are followed. Information from the laboratory and results from samples from similar soils in nearby areas are used to verify field observations and properties that cannot be estimated accurately in the field. The laboratory analyses also help to characterize key soils.

Estimates of soil properties shown in the tables include the range of soil texture, Atterberg limits, engineering classifications, and other physical and chemical properties of the major layers of each soil. Pertinent soil and water features are also given.

Each soil map unit was documented by at least one pedon description for each soil series identified in its name. Pedons were sampled for engineering properties. The analyses were made by the North Dakota State Department of Transportation.

Engineering Index Properties

Table 19, "Engineering Index Properties," gives estimates of the engineering classification and range of index properties for major layers of each named map unit component in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the series descriptions of this publication, under the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 1993) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1986).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups, from A-1 through A-7, on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and plasticity index (Atterberg limits) indicate the plasticity characteristics of a soil. Estimates are based on test data from the survey area or from nearby areas and on field examination.

Estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical Properties

Table 20, "Physical Properties of the Soils," shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the series descriptions of this publication, under the heading "Soil Series and Their Morphology."

Clay consists of mineral soil particles that are less than 0.002 millimeter in diameter. The estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. Clay determines the ability of soil to adsorb cations and retain moisture. Clay influences shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In Table 20, "Physical Properties of the Soils," the estimated range in moist bulk density of each major soil layer is expressed in grams per cubic centimeter of soil material less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. Moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, organic matter content, and soil structure.

Ksat (permeability/saturated hydraulic conductivity) refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water the soil is capable of storing for use by plants. The range in the capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect retention of water and depth of the root zone. The most important soil properties are organic matter content, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain of moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The magnitude of the load on the soil and magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design features are often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The

classes are **low**, a change of less than 3 percent; **moderate**, 3 to 6 percent; and **high**, more than 6 percent. **Very high**, more than 9 percent, is sometimes used.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In Table 20, "Physical Properties of the Soils," the estimated range in organic matter content is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects available water capacity, infiltration rates, and tilth. It is a source of nitrogen and other nutrients for crops.

Erosion factor Kw indicates the susceptibility of a soil to sheet and rill erosion by water. Soil properties that influence erodibility are those that affect the infiltration rate, movement of water though the soil, water storage capacity of the soil, and those that allow the soil to resist dispersion, splashing, abrasion, and the transporting forces of rainfall and runoff. The most important soil properties are the content of silt, sand, and organic matter and soil structure and permeability. The factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are modified by the presence of rock fragments. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion.

Erosion factor Kf is similar to the erosion factor K, except it indicates the erodibility of only the fine-earth fraction, or the material less than 2 millimeters in size.

Soil-loss tolerance factor T is an estimate of the maximum annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is expressed in tons per acre per year. Ratings of 1 to 5 are used depending on soil properties and prior erosion. The criteria used in assigning a T factor to a soil include maintenance of an adequate rooting depth for crop production, potential reduction of crop yields, maintenance of water-control structures affected by sedimentation, prevention of gullying, and the value of nutrients lost through erosion.

Wind erodibility groups (WEG) are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

WEG 1. Coarse sands, sands, fine sands, and very fine sands. These soils generally are not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

WEG 2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

WEG 3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

WEG 4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

WEG 4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are highly erodible. Crops can be grown if measures to control wind erosion are used.

WEG 5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

WEG 6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

WEG 7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

WEG 8. Soils that are not subject to soil blowing because of rock fragments on the surface or because of surface wetness.

Wind erodibility index (I) is a numerical value indicating the potential annual soil loss due to wind erosion for a soil under a well defined set of climatic and management conditions. This factor is expressed as the average annual soil loss in tons per acre per year.

Chemical Properties

Table 21, "Chemical Properties of the Soils," shows estimates of some soil chemical properties that affect soil behavior. These estimates are given for the major layers of each named map unit component in the

survey area. The estimates are based on test data for these and similar soils. These features are described in the following paragraphs.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the series descriptions of this publication, under the heading "Soil Series and Their Morphology."

Clay consists of mineral soil particles that are less than 0.002 millimeter in diameter. The estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material less than 2 millimeters in diameter.

Cation-exchange capacity is the total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations helps to prevent pollution of ground water.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the soil. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization. Calcium carbonate also affects susceptibility of a soil to wind erosion.

Gypsum is given as the percent, by weight, of hydrated calcium sulfates in the soil. Gypsum is partially soluble in water and can be dissolved and removed by water. Soils that have a high content of gypsum (more than 10 percent) may collapse if the gypsum is removed by percolating water.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity (EC) of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of the soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio (SAR) is the measure of sodium relative to calcium and magnesium in the water extract from a saturated soil paste. Soils having a sodium adsorption ratio of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced permeability and aeration, and a general degradation of soil structure.

Water Features

Table 22, "Water Features," gives estimates of several important water features used in land use planning that involves engineering considerations. These features are described in the following paragraphs.

Hydrologic soil groups are groups of soils that have the same runoff potential under similar storm and ground cover conditions. Soil properties that affect the runoff potential are those that influence the rate of infiltration in a bare soil after prolonged wetting and when the soil is not frozen. These properties include the depth to a seasonal high water table, the intake rate, permeability after prolonged wetting, and the depth to a very slowly permeable layer. The influences of ground cover and slope are treated independently and are not taken into account in hydrologic soil groups.

In the definitions of the hydrologic soil groups, the infiltration rate is the rate at which water enters the soil at the surface and is controlled by surface conditions. The transmission rate is the rate at which water moves through the soil and is controlled by properties of the soil layers.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of very deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist mainly of moderately deep or deep, moderately well or well drained soils that have moderately fine to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist mainly of soils having a

layer that impedes the downward movement of water or soils that have a moderately fine or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist mainly of clayey soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups, the first letter is for drained areas and the second is for undrained areas.

Water table (seasonal) refers to a zone in the soil that is at saturation in most years. It is at least 6 inches thick, persists in the soil for more than a few weeks, and is within 6 feet of the surface. Estimates of water table depths are based mainly on the evidence of a saturated zone that exists in a soil, namely a combination of grayish colors or redoximorphic features. Water tables may either be apparent or perched. An apparent water table is indicated by the level at which water stands in a freshly dug, unlined borehole after adequate time is allowed for adjustments in the surrounding soil. A perched water table is water standing above an unsaturated zone in the soil. A perched water table may be separated from a lower water table by an unsaturated zone. Water tables usually are perched by textural discontinuities in the soil profile. A perched water table may be confirmed if the water level in a borehole falls when the borehole is extended.

Indicated in Table 22, "Water Features," are the **upper limit** and **lower limit** in the depth of the water table found in the soil in most years. These depth ranges are given to the nearest tenth of a foot and are listed by month. If no water table exists in the soil, no information is given.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. Ponding of soils is classified according to the depth, duration, frequency, and the beginning and ending months in which water is observed.

Surface water depth is the maximum depth of surface water that is ponded on the soil.

Ponding duration is the average length of time of the ponding occurrence. Ponding duration classes are **very brief** (less than 2 days), **brief** (2 to 7 days), **long** (7 to 30 days), or **very long** (more than 30 days).

Ponding frequency is the number of times ponding occurs over a period of time. Ponding frequency classes are **none** (no reasonable possibility of ponding), **rare** (ponding unlikely but possible under unusual weather conditions; 0 to 5 percent chance of ponding in any year); **occasional** (ponding is expected infrequently under usual weather conditions; 5 to 50 percent chance of ponding in any year); and **frequent** (ponding is likely to occur under usual weather conditions; more than 50 percent chance in any year).

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflow from streams or by runoff from adjacent slopes. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in marshes and swamps or in closed depressions is considered to be ponding.

Table 22, "Water Features," gives the **duration** and **frequency** of flooding and the time of year when flooding is most likely to occur. Flooding frequency classes are identical to ponding frequency classes. Flooding duration classes are **extremely brief** (0.1 to 4 hours), **very brief** (4 to 48 hours), **brief** (2 to 7 days), **long** (7 to 30 days), and **very long** (more than 30 days). Frequency, duration, and probable dates of occurrence are estimated.

The information on flooding is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered in making flooding estimates are local information about the extent and level of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Soil Features

Table 23, "Soil Features," gives estimates of several important soil features used in land use planning that involves engineering considerations. These features are described in the following paragraphs.

Restrictive layers are nearly continuous soil layers that significantly reduce the movement of water and air through the soil or that otherwise provide an unfavorable root environment. Restriction **kind** is the type of restriction. Examples of restrictions include bedrock, cemented layers, and dense layers. Restriction **thickness** is the distance from the top to

the bottom of a restrictive layer. Restriction **hardness** refers to the rupture resistance or strength of the layer.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, organic matter content, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly-structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage to pavements and other rigid structures.

A **low** potential for frost action indicates that the soil is rarely susceptible to the formation of ice lenses; a **moderate** potential indicates that the soil is susceptible to formation of ice lenses, resulting in frost heave and the subsequent loss of soil strength; and a **high** potential indicates that the soil is highly susceptible to formation of ice lenses, resulting in frost heave and the subsequent loss of soil strength.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil.

Special site examination and design features may be needed if the combination of factors results in a severe hazard of corrosion. Steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For **uncoated steel**, the risk of corrosion, expressed as **low**, **moderate**, or **high**, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For **concrete**, the risk of corrosion is also expressed as **low**, **moderate**, or **high**. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Hydric Soils

Table 24, "Hydric Soils List," shows which map units have components that meet the definition of hydric soils in Ransom County. This table can help in planning land uses; however, onsite investigation is recommended to determine the hydric soils on a specific site (National Research Council, 1995; USDA-NRCS, 1996.) Map units that are made up of hydric soils may have small areas or inclusions, of nonhydric soils in the higher positions on the landform, and map units made up of nonhydric soils may have inclusions of hydric soils in the lower positions of the landform.

Three essential characteristics of wetlands are hydrophytic vegetation, hydric soils, and wetland hydrology (Cowardin, et al., 1979; Environmental Laboratory, 1987; National Research Council, 1995; Tiner, 1985). Criteria for each of the characteristics must be met for areas to be identified as wetlands. Undrained hydric soils that have natural vegetation should support a dominant population of ecological wetland plant species. Hydric soils that have been converted to other uses should be capable of being restored to wetlands.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). These soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria which identify those estimated soil properties unique to hydric soils have been established (Federal Register, 1995.) These criteria are used to identify a phase of a soil series that normally is associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1975; 1996a) and in the "Soil Survey Manual" (Soil Survey Staff, 1993.)

If soils are wet enough for a long enough period to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils.

The indicators that can be used to make onsite determinations of hydric soils in Ransom County are specified in "Field Indicators of Hydric Soils in the United States" (USDA-NRCS, 1996).

Hydric soils are identified by examining and describing the soil to a depth of about 20 inches. This depth may be greater if determination of an appropriate indicator so requires. It is always recommended that soils be excavated and described as deep as necessary to understand the redoximorphic processes. Then, using the completed soil description, soil scientists can compare soil features required by each hydric soil indicator and specify which indicators have been matched with the conditions observed in the soil. The soil can be identified as a hydric soil if one (or more) of the approved indicators is present.

This survey can be used to locate probable areas of hydric soils. The hydric soil may have been artificially drained or otherwise altered such that it no longer supports a predominance of hydrophytic vegetation. The soil map does not identify drained areas.

Table 19.—Engineering Index Properties

(The symbol < means less than; > means greater than. Dashes (---) indicate that an assignment has not been made.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number—: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
64:												
Arveson	0-7	Fine sandy loam	SM	A-2-4, A-4	---	0-1	100	95-100	55-85	30-50	0-30	NP-7
	7-31	Fine sandy loam, sandy loam, loam	SC-SM, SM	A-4	0	0	100	95-100	60-85	35-50	0-20	NP-5
	31-60	Fine sand, loamy sand, fine sandy loam	SC-SM, SM, SP-SM	A-2, A-3, A-4	0	0	100	95-100	50-85	5-50	0-20	NP-5
76:												
Arvilla	0-8	Sandy loam	SM, SC-SM, SC	A-2, A-4, A-6	0	0	95-100	90-100	50-80	20-45	15-30	NP-15
	8-15	Sandy loam, loam, coarse sandy loam	SC, SM, SC-SM	A-2, A-6, A-4	0	0	90-100	85-100	50-80	20-45	15-40	NP-15
	15-60	Gravelly coarse sand, coarse sand, very gravelly coarse sand	GM, SP-SM, GP-GM, SP	A-2, A-1, A-3	0	0	35-100	25-100	10-60	0-15	---	NP
86:												
Aylmer	0-7	Fine sand	SM, SP-SM	A-2, A-3	0	0	100	100	65-100	5-25	0-14	NP
	7-60	Fine sand, sand	SP-SM, SM	A-2, A-3	0	0	100	100	65-100	5-25	0-14	NP
Bantry	0-5	Fine sand	SM, SP-SM	A-2, A-3	0	0	100	100	65-95	5-25	0-14	NP
	5-60	Fine sand, sand	SM, SP-SM	A-2, A-3	0	0	100	100	65-95	5-25	0-14	NP
118:												
Barnes	0-7	Loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	80-100	60-80	25-35	10-20
	7-15	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	75-95	55-80	25-45	10-25
	15-28	Loam			0	---	90-100	85-100	75-95	55-80	25-45	10-25
	28-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	75-95	55-80	25-45	10-25
Buse	0-6	Loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-95	70-95	55-90	25-35	10-15
	6-60	Loam, clay loam	CL, CL-ML	A-6, A-4, A-7	0	0-5	90-100	85-100	70-90	55-85	25-45	10-25
120:												
Barnes	0-7	Loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	80-100	60-80	25-35	10-20
	7-15	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	75-95	55-80	25-45	10-25
	15-28	Loam			0	---	90-100	85-100	75-95	55-80	25-45	10-25
	28-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	75-95	55-80	25-45	10-25
Buse	0-6	Loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-95	70-95	55-90	25-35	10-15
	6-60	Loam, clay loam	CL, CL-ML	A-6, A-4, A-7	0	0-5	90-100	85-100	70-90	55-85	25-45	10-25
154:												
Barnes	0-7	Loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	80-100	60-80	25-35	10-20
	7-15	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	75-95	55-80	25-45	10-25
	15-28	Loam			0	---	90-100	85-100	75-95	55-80	25-45	10-25
	28-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	75-95	55-80	25-45	10-25
Svea	0-12	Loam	CL, CL-ML	A-4, A-6	---	0-5	95-100	85-100	80-95	60-90	25-40	10-20
	12-33	Loam, silt loam, clay loam	CL, CL-ML	A-6, A-4, A-7	---	0-5	95-100	85-100	80-100	60-90	25-45	10-25
	33-60	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6, A-7	---	0-5	95-100	85-100	80-100	60-85	25-45	10-25

Table 19.—Engineering Index Properties--(continued)

(The symbol < means less than; > means greater than. Dashes (—) indicate that an assignment has not been made.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number—: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
156:												
Barnes----------	0-7	Loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	80-100	60-80	25-35	10-20
	7-15	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	75-95	55-80	25-45	10-25
	15-28	Loam			0	—	90-100	85-100	75-95	55-80	25-45	10-25
	28-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	75-95	55-80	25-45	10-25
Svea------------	0-12	Loam	CL, CL-ML	A-4, A-6	—	0-5	95-100	85-100	80-95	60-90	25-40	10-20
	12-33	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6, A-7	—	0-5	95-100	85-100	80-100	60-90	25-45	10-25
	33-60	Loam, silt loam, clay loam	CL, CL-ML	A-6, A-4, A-7	—	0-5	95-100	85-100	80-100	60-85	25-45	10-25
314:												
Buse------------	0-6	Loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-95	70-95	55-90	25-35	10-15
	6-60	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0	0-5	90-100	85-100	70-90	55-85	25-45	10-25
Barnes----------	0-7	Loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	80-100	60-80	25-35	10-20
	7-15	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	75-95	55-80	25-45	10-25
	15-28	Loam			0	—	90-100	85-100	75-95	55-80	25-45	10-25
	28-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	75-95	55-80	25-45	10-25
450:												
Colvin----------	0-12	Silt loam	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	80-95	30-35	10-15
	12-36	Silt loam, silty clay loam	CL, CL-ML	A-4, A-7, A-6	0	0	100	100	90-100	80-95	30-45	10-20
	36-60	Loam, silt loam, silty clay loam	CL, CL-ML	A-6, A-4, A-7	0	0	100	100	90-100	70-95	30-45	10-20
493:												
Darnen----------	0-22	Loam	OL, CL, CL-ML, ML	A-4	0	0	100	100	85-100	60-90	20-35	2-10
	22-31	Loam, clay loam	CL-ML, CL	A-4, A-6, A-7	0	0	95-100	90-100	85-100	60-90	20-45	5-25
	31-60	Loam, clay loam	CL, CL-ML	A-4, A-7, A-6	0	0	90-100	90-100	80-95	50-85	20-45	5-25
510:												
Divide----------	0-12	Loam	CL, CL-ML	A-4, A-6	0	0-5	95-100	95-100	85-95	60-85	25-35	5-15
	12-29	Loam, clay loam, gravelly loam	CL, CL-ML	A-6, A-7	0	0-5	95-100	75-100	55-90	35-80	30-45	10-25
	29-60	Stratified sand to gravelly sand	SM, GP-GM, SP-SM	A-1, A-2, A-3	0	0-5	25-100	15-100	10-70	5-25	0-15	NP-5
571:												
Embden----------	0-12	Fine sandy loam, sandy loam	CL-ML, SC, SC-SM	A-2, A-4	0	0	100	100	60-95	30-75	20-30	4-10
	12-25	Fine sandy loam, sandy loam	CL-ML, SC, SC-SM	A-2, A-4	0	0	100	100	60-100	25-55	20-30	5-10
	25-60	Fine sandy loam, sandy loam, loamy fine sand	CL-ML, SC, SM	A-2, A-4	0	0	100	100	50-100	15-55	15-30	NP-10

Table 19.--Engineering Index Properties--(continued)

(The symbol < means less than; > means greater than. Dashes (--) indicate that an assignment has not been made.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct	Pct					Pct	
726:												
Fordville-------	0-9	Loam	ML, CL	A-6, A-4, A-7	0	0	100	100	70-85	55-75	30-45	5-20
	9-23	Loam, silt loam, clay loam	ML, CL	A-4, A-6, A-7	0	0	100	95-100	70-95	55-80	30-45	5-20
	23-30	Loam, clay loam, fine sandy loam	SC, ML, SM, CL	A-4, A-6	0	0	95-100	90-100	65-90	40-55	25-40	3-15
	30-60	Loamy sand, gravelly loam, very gravelly sand, gravelly coarse sand	SM, SW-SM, SW	A-1	0	0	65-95	45-90	15-45	0-15	0-25	NP-5
772:												
Gardena---------	0-14	Loam	CL, ML	A-4, A-6	0	0	100	100	95-100	65-100	25-40	NP-15
	14-60	Silt loam, very fine sandy loam, loam	CL-ML, ML, CL	A-4, A-6	0	0	100	100	75-100	55-100	20-40	NP-15
Eckman----------	0-13	Loam	ML	A-4	0	0	100	100	85-100	60-75	18-38	NP-10
	13-37	Silt loam, very fine sandy loam	ML	A-4	0	0	100	100	85-100	55-90	20-40	NP-10
	37-60	Silt loam, very fine sandy loam, fine sandy loam	ML, SM	A-4	0	0	100	100	65-100	40-90	20-40	NP-10
794:												
Glyndon---------	0-8	Loam	ML	A-4	0	0	100	100	95-100	70-95	20-40	NP-10
	8-31	Silt loam, very fine sandy loam, loam	CL, CL-ML, ML	A-4	0	0	100	100	90-100	80-95	20-30	NP-10
	31-60	Loamy very fine sand, fine sand, very fine sandy loam	ML, CL, SC, SM	A-4, A-6	0	0	100	100	85-100	35-75	10-35	NP-15
795:												
Glyndon, saline-	0-8	Loam	ML	A-4	0	0	100	100	95-100	70-85	18-38	NP-10
	8-31	Silt loam, very fine sandy loam	CL, CL-ML, ML	A-4	0	0	100	100	90-100	80-95	20-30	NP-10
	31-60	Loamy very fine sand, very fine sand	CL-ML, CL, ML	A-4	0	0	100	100	85-100	50-90	10-30	NP-10
852:												
Hamar-----------	0-15	Fine sandy loam, loamy fine sand	SC-SM, SM	A-2, A-4	0	0	100	100	85-100	15-40	0-25	NP-5
	15-23	Loamy fine sand, loamy sand, fine sand	SC-SM, SP-SM, SM	A-2, A-4	0	0	100	100	70-100	10-40	0-25	NP-5
	23-60	Fine sand, loamy sand, loamy fine sand	SC-SM, SP-SM, SM	A-2	0	0	100	100	70-100	10-35	0-25	NP-5

Table 19.—Engineering Index Properties--(continued)

(The symbol < means less than; > means greater than. Dashes (—) indicate that an assignment has not been made.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number—: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
883:												
Hamerly	0-8	Loam	CL, CL-ML	A-4, A-6	0	0-5	95-100	90-100	80-95	60-90	20-40	5-20
	8-22	Loam, clay loam	CL, CL-ML	A-6, A-4, A-7	0	0-5	95-100	90-100	80-95	60-75	20-45	5-25
	22-60	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0	0-5	95-100	90-100	75-95	55-75	20-45	5-25
Tonka	0-19	Silt loam	CL, CL-ML	A-4, A-6	0-1	0-2	100	95-100	90-100	70-90	35-45	15-25
	19-34	Silty clay loam, clay loam, clay	CH, CL	A-6, A-7	0-1	0-2	100	95-100	90-100	75-95	50-60	30-40
	34-60	Silty clay loam, clay loam, loam	CL, CL-ML	A-7, A-4, A-6	0-1	0-3	90-100	85-100	60-100	50-90	35-55	15-30
Parnell	0-17	Silty clay loam	CL, CH, OL	A-7	0	0-1	100	100	95-100	85-100	40-55	20-35
	17-60	Clay loam, silty clay loam, silty clay	CH, CL	A-7	0	0-2	95-100	90-100	80-95	70-95	50-60	30-40
939:												
Hecla	0-18	Loamy fine sand	SC-SM, SM, SP-SM	A-2	0	0	100	95-100	85-100	12-35	10-20	NP-5
	18-27	Loamy sand, loamy fine sand, fine sand	SM, SC-SM, SP-SM	A-2, A-3	0	0	100	95-100	85-100	5-35	10-20	NP-5
	27-60	Loamy sand, fine sand, loamy fine sand	SM, SC-SM, SP-SM	A-2, A-3	0	0	100	95-100	85-100	5-35	10-20	NP-5
Hamar	0-15	Loamy fine sand	SC-SM, SM	A-2, A-4	0	0	100	100	85-100	15-40	0-25	NP-5
	15-23	Loamy fine sand, loamy sand, fine sand	SM, SC-SM, SP-SM	A-2, A-4	0	0	100	100	70-100	10-40	0-25	NP-5
	23-60	Fine sand, loamy sand, loamy fine sand	SC-SM, SM, SP-SM	A-2	0	0	100	100	70-100	10-35	0-25	NP-5
1030:												
Kranzburg	0-9	Silty clay loam	CH, CL	A-7	0	0	100	100	95-100	90-100	40-55	15-30
	9-27	Silty clay loam, silt loam	CH, CL	A-7	0	0	100	100	95-100	85-100	40-55	15-30
	27-39	Clay loam, loam	CL	A-6, A-7	0	0	95-100	90-100	80-100	65-85	30-50	10-30
	39-60	Clay loam, loam	CL	A-6, A-7	0	0	95-100	90-100	80-100	65-85	30-50	10-30
Lismore	0-17	Silty clay loam	CL	A-6, A-7	0	0	100	100	95-100	90-100	35-50	15-25
	17-27	Loam, clay loam	CL	A-6, A-7	0	0	100	95-100	85-100	70-85	30-50	10-25
	27-36	Loam, clay loam	CL	A-6, A-7	0	0	100	95-100	85-100	70-85	30-50	10-25
	36-60	Loam, clay loam	CL	A-6, A-7	0	0	100	95-100	85-100	70-85	30-50	10-25

Table 19.—Engineering Index Properties--(continued)

(The symbol < means less than; > means greater than. Dashes (—) indicate that an assignment has not been made.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number—: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
1043:												
La Prairie------	0-17	Loam	CL, CL-ML	A-4, A-6	0	0	100	100	85-95	70-80	25-40	5-15
	17-35	Silt loam, loam, silty clay loam	CL, CL-ML	A-4, A-6, A-7	0	0	100	100	85-100	70-95	25-50	5-25
	35-60	Stratified fine sandy loam to silty clay loam	CL, SC-SM, CL-ML, SC	A-4, A-7, A-6	0	0	100	95-100	75-100	45-90	25-50	5-25
1055:												
LaDelle---------	0-20	Silt loam	CL, ML	A-6, A-4, A-7	0	0	100	100	90-100	80-100	30-45	7-20
	20-50	Silt loam, silty clay loam, loam	CL, CH, MH, ML	A-6, A-7	0	0	100	100	90-100	75-100	30-55	10-25
	50-60	Stratified silt loam to clay loam	CL, CL-ML	A-6, A-4, A-7	0	0	100	100	90-100	75-100	25-50	5-25
1081:												
Lamoure---------	0-10	Silt loam	CL, ML	A-6, A-7	0	0	100	100	95-100	85-100	35-50	10-25
	10-26	Silty clay loam, silt loam	CL, MH, CH, ML	A-7	0	0	100	100	90-100	60-100	40-70	15-35
	26-60	Stratified sandy loam to silty clay loam	CL, SC	A-6, A-7	0	0	95-100	95-100	70-95	35-90	30-70	10-35
1168:												
Lismore---------	0-17	Silty clay loam	CL	A-6, A-7	0	0	100	100	95-100	90-100	35-50	15-25
	17-27	Loam, clay loam	CL	A-6, A-7	0	0	100	95-100	85-100	70-85	30-50	10-25
	27-36	Loam, clay loam	CL	A-6, A-7	0	0	100	95-100	85-100	70-85	30-50	10-25
	36-60	Loam, clay loam	CL	A-6, A-7	0	0	100	95-100	85-100	70-85	30-50	10-25
Kranzburg-------	0-9	Silty clay loam	CH, CL	A-7	0	0	100	100	95-100	90-100	40-55	15-30
	9-27	Silty clay loam, silt loam	CH, CL	A-7	0	0	100	100	95-100	85-100	40-55	15-30
	27-39	Clay loam, loam	CL	A-6, A-7	0	0	95-100	90-100	80-100	65-85	30-50	10-30
	39-60	Clay loam, loam	CL	A-6, A-7	0	0	95-100	90-100	80-100	65-85	30-50	10-30
1205:												
Maddock---------	0-14	Loamy fine sand	SC-SM, SM	A-2, A-4	0	0	100	95-100	50-80	15-35	15-20	NP-5
	14-60	Loamy sand, loamy fine sand, fine sand	SC-SM, SM, SP-SM	A-2, A-3	0	0	100	95-100	60-100	5-35	15-20	NP-3
1221:												
Maddock---------	0-14	Loamy fine sand	SC-SM, SM	A-2, A-4	0	0	100	95-100	50-80	15-35	15-20	NP-5
	14-60	Loamy sand, loamy fine sand, fine sand	SC-SM, SP-SM, SM	A-2, A-3	0	0	100	95-100	60-100	5-35	15-20	NP-3

Table 19.—Engineering Index Properties--(continued)

(The symbol < means less than; > means greater than. Dashes (—) indicate that an assignment has not been made.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number—: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
1221: (con't)												
Hecla-----------	0-18	Loamy fine sand	SC-SM, SM, SP-SM	A-2	0	0	100	95-100	85-100	12-35	10-20	NP-5
	18-27	Loamy sand, loamy fine sand, fine sand	SC-SM, SM, SP-SM	A-2, A-3	0	0	100	95-100	85-100	5-35	10-20	NP-5
	27-60	Loamy sand, fine sand, loamy fine sand	SC-SM, SM, SP-SM	A-2, A-3	0	0	100	95-100	85-100	5-35	10-20	NP-5
1269:												
Marysland-------	0-14	Loam	CL	A-4, A-6, A-7	0	0-5	95-100	95-100	85-95	50-80	25-50	10-25
	14-22	Loam, clay loam, sandy clay loam	CL, SC	A-6, A-7	0	0-5	90-100	85-100	80-95	45-80	20-45	10-20
	22-60	Stratified gravelly coarse sand to fine sand	GP-GM, SP-SM, SM	A-1, A-2, A-3	0	0-5	50-95	35-90	35-70	5-20	0-15	NP-5
1403:												
Overly----------	0-17	Silty clay loam	CL	A-6, A-7	0	0	100	100	90-100	80-100	30-45	10-25
	17-56	Silty clay loam, silt loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0	0	100	100	90-100	80-100	25-50	5-30
	56-60	Stratified silt loam to silty clay	CL, CL-ML	A-4, A-7, A-6	0	0	100	100	90-100	80-100	25-50	5-30
1427:												
Parnell---------	0-17	Silty clay loam	CH, OL, CL	A-7	0	0-1	100	100	95-100	85-100	40-55	20-35
	17-60	Clay loam, silty clay loam, silty clay	CH, CL	A-7	0	0-2	95-100	90-100	80-95	70-95	50-60	30-40
1466:												
Pits, gravel and sand-------	0-6	Extremely gravelly sand	GW-GM, SW-SM	A-1, A-3	0	0-5	25-90	10-65	5-35	0-25	0-15	NP-5
	6-60	Extremely gravelly sand, extremely gravelly coarse sand, gravelly coarse sandy loam	GW-GM, SW-SM	A-1, A-3	0	0-10	25-90	10-65	5-35	0-25	0-15	NP-5
1472:												
Rauville--------	0-40	Silty clay loam	CL, ML	A-6, A-7	0	0	100	100	90-100	80-100	35-50	10-25
	40-60	Silty clay loam, silt loam, silty clay	CH, ML, CL, MH	A-6, A-7	0	0	100	100	90-100	85-100	35-60	15-28

Table 19.--Engineering Index Properties--(continued)

(The symbol < means less than; > means greater than. Dashes (--) indicate that an assignment has not been made.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
1523:												
Renshaw	0-7	Loam	ML	A-4	0	0-5	95-100	90-100	70-100	50-75	20-40	NP-10
	7-15	Loam, sandy clay loam, gravelly loam	CL, SC-SM, ML, SC	A-4, A-6	0	0-5	95-100	55-100	45-90	35-70	20-40	3-15
	15-60	Gravelly loamy sand, very gravelly loamy sand, gravelly sand	SM, SW, GW-GM, SW-SM	A-1, A-2	0	0-5	45-95	30-80	10-60	0-15	0-25	NP-5
1560:												
Rifle	0-9	Peat	PT	A-8	0	0	---	---	---	---	---	---
	9-60	Mucky peat	PT	A-8	0	0	---	---	---	---	---	---
1577:												
Rosewood	0-14	Fine sandy loam	SC-SM, SC, SM	A-2, A-4	0	0	100	97-100	65-90	30-50	0-30	NP-10
	14-19	Fine sandy loam, loamy fine sand, sandy loam	SC, SC-SM, SM	A-2, A-4	0	0	100	95-100	60-85	25-45	0-30	NP-10
	19-60	Fine sand, sand	SM, SP-SM	A-1, A-3, A-2	0	0	85-100	75-95	45-75	5-25	0-14	NP
1648:												
Serden	0-5	Fine sand	SM	A-2	0	0	100	100	65-85	15-25	---	NP
	5-60	Fine sand, sand	SM, SP-SM	A-2, A-3	0	0	100	100	65-85	5-25	---	NP
Duneland	0-6	Fine sand	SP, SM, SP-SM	A-2, A-3	0	0	100	100	60-80	0-25	0-14	NP
	6-60	Sand, fine sand	SM, SP, SP-SM	A-2, A-3	0	0	100	100	50-80	0-25	0-14	NP
1670:												
Ulen	0-14	Fine sandy loam	SC, SC-SM, SM	A-4	0	0	100	100	80-100	35-50	0-25	NP-8
	14-30	Loamy fine sand, fine sand	SM	A-2	0	0	100	95-100	70-95	12-35	0-14	NP
	30-60	Fine sand, loamy fine sand, sand	SM, SP-SM	A-2, A-3	0	0	100	95-100	80-100	5-35	0-14	NP
Rosewood	0-14	Fine sandy loam	SC-SM, SC, SM	A-2, A-4	0	0	100	97-100	65-90	30-50	0-30	NP-10
	14-19	Fine sandy loam, loamy fine sand, sandy loam	SC-SM, SC, SM	A-2, A-4	0	0	100	95-100	60-85	25-45	0-30	NP-10
	19-60	Fine sand, sand	SM, SP-SM	A-1, A-3, A-2	0	0	85-100	75-95	45-75	5-25	0-14	NP
1704:												
Sioux	0-7	Sandy loam	SM	A-4	0	0-5	95-100	85-100	60-85	35-45	20-30	NP-7
	7-60	Extremely gravelly sand, very gravelly loamy sand, very gravelly sand	GP, GM, SM, SP	A-1	0	0-5	25-75	20-60	5-35	0-25	0-25	NP-5

Table 19.—Engineering Index Properties--(continued)

(The symbol < means less than; > means greater than. Dashes (—) indicate that an assignment has not been made.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number—: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
1704: (con't)												
Renshaw---------	0-7	Loam	ML	A-4	0	0-5	95-100	90-100	70-100	50-75	20-40	NP-10
	7-15	Loam, sandy clay loam, gravelly loam	CL, SC-SM, ML, SC	A-4, A-6	0	0-5	95-100	55-100	45-90	35-70	20-40	3-15
	15-60	Gravelly loamy sand, very gravelly loamy sand, gravelly sand	SM, SW, GW-GM, SW-SM	A-1, A-2	0	0-5	45-95	30-80	10-60	0-15	0-25	NP-5
1709:												
Southam---------	0-8	Silt loam	CL, CL-ML, OL	A-6	0	0	100	95-100	90-100	85-100	30-40	10-20
	8-33	Silty clay, clay, silty clay loam	CH, CL	A-7	0	0	100	95-100	90-100	85-100	50-65	30-40
	33-60	Silty clay, silty clay loam, loam	CH, CL, CL-ML	A-6, A-7	0	0-1	100	95-100	85-100	60-100	35-65	15-40
1772:												
Svea------------	0-12	Loam	CL, CL-ML	A-4, A-6	—	0-5	95-100	85-100	80-95	60-90	25-40	10-20
	12-33	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6, A-7	—	0-5	95-100	85-100	80-100	60-90	25-45	10-25
	33-60	Loam, silt loam, clay loam	CL-ML, CL	A-4, A-7, A-6	—	0-5	95-100	85-100	80-100	60-85	25-45	10-25
Gardena---------	0-14	Loam	CL, ML	A-4, A-6	0	0	100	100	95-100	65-100	25-40	NP-15
	14-60	Silt loam, very fine sandy loam, loam	CL, CL-ML, ML	A-4, A-6	0	0	100	100	75-100	55-100	20-40	NP-15
1788:												
Swenoda---------	0-8	Fine sandy loam	SC-SM, SM	A-2, A-4	0	0	100	95-100	70-100	30-50	20-30	5-10
	8-29	Fine sandy loam, sandy loam, loamy fine sand	CL-ML, SC-SM	A-2, A-4	0	0	100	95-100	60-100	30-60	20-30	5-10
	29-60	Silt loam, silty clay loam, loam	CL, CL-ML	A-6, A-7	0	0-5	90-100	90-100	75-100	50-95	30-45	10-20
Barnes----------	0-7	Loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	80-100	60-80	25-35	10-20
	7-15	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	75-95	55-80	25-45	10-25
	15-28	Loam			0	—	90-100	85-100	75-95	55-80	25-45	10-25
	28-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	75-95	55-80	25-45	10-25
1834:												
Tonka-----------	0-19	Silt loam	CL, CL-ML	A-4, A-6	0-1	0-2	100	95-100	90-100	70-90	35-45	15-25
	19-34	Silty clay loam, clay loam, clay	CH, CL	A-6, A-7	0-1	0-2	100	95-100	90-100	75-95	50-60	30-40
	34-60	Silty clay loam, clay loam, loam	CL, CL-ML	A-6, A-4, A-7	0-1	0-3	90-100	85-100	60-100	50-90	35-55	15-30

Table 19.—Engineering Index Properties--(continued)

(The symbol < means less than; > means greater than. Dashes (—) indicate that an assignment has not been made.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number— 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
1842:												
Towner	0-20	Loamy fine sand	SC-SM, SM	A-2	0	0	100	100	50-80	15-35	15-25	NP-5
	20-29	Loamy sand, loamy fine sand, fine sand	SM, SC-SM, SW-SM	A-2, A-3	0	0	100	95-100	50-100	5-35	15-25	NP-5
	29-60	Loam, silt loam, silty clay loam	CL, CL-ML	A-4, A-6, A-7	0	0-5	95-100	90-100	85-100	55-100	25-50	5-30
1859:												
Ulen	0-14	Fine sandy loam	SC, SM, SC-SM	A-4	0	0	100	100	80-100	35-50	0-25	NP-8
	14-30	Loamy fine sand, fine sand	SM	A-2	0	0	100	95-100	70-95	12-35	0-14	NP
	30-60	Fine sand, loamy fine sand, sand	SM, SP-SM	A-2, A-3	0	0	100	95-100	80-100	5-35	0-14	NP
1871:												
Vallers, saline	0-12	Loam	CL, CL-ML	A-4, A-6	0-1	0-5	95-100	90-100	80-90	65-80	25-40	10-20
	12-38	Clay loam, silty clay loam, loam	CL	A-4, A-6, A-7	0-1	0-5	95-100	90-100	80-95	50-80	25-45	10-25
	38-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-1	0-5	95-100	90-100	85-95	60-75	25-45	10-25
1883:												
Vallers	0-12	Loam	CL-ML, ML	A-4	0-1	0-5	95-100	90-100	80-90	50-80	30-40	4-10
	12-38	Clay loam, silty clay loam, loam	CL	A-6	0-1	0-5	95-100	90-100	80-95	50-80	30-40	11-20
	38-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-1	0-5	95-100	90-100	85-95	60-85	20-40	5-20
Parnell	0-17	Silty clay loam	CL, CH, OL	A-7	0	0-1	100	100	95-100	85-100	40-55	20-35
	17-60	Clay loam, silty clay loam, silty clay	CH, CL	A-7	0	0-2	95-100	90-100	80-95	70-95	50-60	30-40
1935:												
Venlo	0-13	Fine sandy loam	SC-SM, SM	A-2, A-4	0	0	100	100	60-85	30-50	0-25	NP-5
	13-60	Loamy fine sand, loamy sand, fine sand	SM, SP-SM	A-2, A-3	0	0	100	100	50-80	5-35	0-20	NP
1953:												
Wahpeton	0-19	Silty clay	CH	A-7	0	0	100	100	95-100	80-95	50-75	25-50
	19-60	Clay, silty clay, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	95-100	80-95	35-75	20-50
1978:												
Water	—	—	—	—	—	—	—	—	—	—	—	—

Table 19.—Engineering Index Properties--(continued)

(The symbol < means less than; > means greater than. Dashes (—) indicate that an assignment has not been made.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
2049:												
Wyndmere--------	0-9	Loam	CL, ML, CL-ML	A-4	0	0	100	100	85-95	50-70	15-25	NP-10
	9-27	Sandy loam, fine sandy loam	SC, ML, SC-SM, SM	A-2, A-4	0	0	100	100	60-90	30-55	15-25	NP-10
	27-60	Fine sand, loamy fine sand, fine sandy loam	CL-ML, SM, ML, SC-SM	A-2, A-4	0	0	100	100	60-100	20-55	15-25	NP-10
2091:												
Zell------------	0-7	Loam	CL-ML, CL, ML	A-4	0	0	100	95-100	85-100	80-100	20-30	5-10
	7-29	Silt loam, very fine sandy loam, loam	CL, CL-ML, ML	A-4	0	0	100	95-100	85-100	70-100	20-30	5-10
	29-60	Silt loam, very fine sandy loam, loam	CL, CL-ML, ML	A-4	0	0	100	95-100	85-100	60-100	15-30	NP-10
2206:												
Barnes----------	0-7	Loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	80-100	60-80	25-35	10-20
	7-15	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	75-95	55-80	25-45	10-25
	15-28	Loam			0	—	90-100	85-100	75-95	55-80	25-45	10-25
	28-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	75-95	55-80	25-45	10-25
Sioux-----------	0-7	Sandy loam	SM	A-4	0	0-5	95-100	85-100	60-85	35-45	20-30	NP-7
	7-60	Extremely gravelly sand, very gravelly loamy sand, very gravelly sand	GM, SP, GP, SM	A-1	0	0-5	25-75	20-60	5-35	0-25	0-25	NP-5
2207:												
Bearden---------	0-9	Silt loam	CH, CL	A-6, A-7	0	0	100	100	95-100	80-95	25-55	10-30
	9-43	Silt loam, silty clay loam	CH, CL	A-6, A-7	0	0	100	100	90-100	80-95	25-55	10-30
	43-60	Sand, fine sand	SM, SP-SM	A-2, A-3	0	0	100	100	50-80	5-35	0-20	NP
2208:												
Brantford-------	0-9	Loam	CL, CL-ML	A-4	0	0	90-100	85-95	80-90	60-80	20-30	4-10
	9-16	Loam	CL, CL-ML	A-4, A-6	0	0	90-100	85-95	80-90	60-80	30-35	10-15
	16-60	Very gravelly sand, stratified very gravelly coarse sand to loamy sand	GM, SP-SM, GP-GM, SM	A-1, A-3, A-2	0	5-25	50-95	30-75	15-60	5-30	15-20	NP-5
Coe-------------	0-7	Loam	SC, CL-ML, SC-SM, SM	A-2, A-4	0	0-5	95-100	95-100	60-80	30-55	15-30	NP-10
	7-60	Gravelly coarse sand, gravelly loamy coarse sand, very gravelly sand	GM, SP-SM, GP-GM, SM	A-1, A-3, A-2	0	5-25	50-95	30-75	15-60	5-30	15-20	NP-3

Table 19.—Engineering Index Properties--(continued)

(The symbol < means less than; > means greater than. Dashes (—) indicate that an assignment has not been made.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number—: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
2209:												
Buse------------	0-6	Loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-95	70-95	55-90	25-35	10-15
	6-60	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0	0-5	90-100	85-100	70-90	55-85	25-45	10-25
Barnes----------	0-7	Loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	80-100	60-80	25-35	10-20
	7-15	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	75-95	55-80	25-45	10-25
	15-28	Loam			0	—	90-100	85-100	75-95	55-80	25-45	10-25
	28-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	75-95	55-80	25-45	10-25
2210:												
Cathay----------	0-14	Bouldery loam	CL, CL-ML, ML	A-4	15-30	5-40	95-100	90-100	75-95	50-95	25-35	5-10
	14-21	Bouldery loam, bouldery clay loam	CL	A-6	15-30	5-40	95-100	90-100	85-95	65-85	25-40	10-25
	21-60	Bouldery loam	CL, CL-ML, ML	A-4, A-6	15-30	5-40	95-100	90-100	85-95	60-75	25-40	3-18
Larson----------	0-10	Bouldery loam	CL, CL-ML	A-4, A-6	15-30	5-40	95-100	85-100	75-100	50-90	15-40	5-20
	10-22	Bouldery loam, bouldery clay loam, bouldery silty clay loam	CL	A-6, A-7	15-30	5-40	95-100	85-100	75-100	60-80	30-45	10-25
	22-60	Bouldery loam, bouldery clay loam, bouldery silt loam	CL, CL-ML	A-6, A-4, A-7	15-30	5-40	95-100	85-100	75-100	55-90	15-45	5-25
2211:												
Eckman----------	0-6	Loam	ML	A-4	0	0	100	100	85-100	60-75	18-38	NP-10
	6-37	Silt loam, very fine sandy loam	ML	A-4	0	0	100	100	85-100	55-90	20-40	NP-10
	37-60	Silt loam, very fine sandy loam, fine sandy loam	ML, SM	A-4	0	0	100	100	65-100	40-90	20-40	NP-10
Gardena---------	0-14	Loam	CL, ML	A-4, A-6	0	0	100	100	95-100	65-100	25-40	NP-15
	14-60	Silt loam, very fine sandy loam, loam	CL-ML, CL, ML	A-4, A-6	0	0	100	100	75-100	55-100	20-40	NP-15
2212:												
Eckman----------	0-6	Loam	ML	A-4	0	0	100	100	85-100	60-75	18-38	NP-10
	6-37	Silt loam, very fine sandy loam	ML	A-4	0	0	100	100	85-100	55-90	20-40	NP-10
	37-60	Silt loam, very fine sandy loam, fine sandy loam	ML, SM	A-4	0	0	100	100	65-100	40-90	20-40	NP-10
Zell------------	0-7	Loam	CL, CL-ML, ML	A-4	0	0	100	95-100	85-100	80-100	20-30	5-10
	7-29	Silt loam, very fine sandy loam, loam	CL, CL-ML, ML	A-4	0	0	100	95-100	85-100	70-100	20-30	5-10
	29-60	Silt loam, very fine sandy loam, loam	CL, CL-ML, ML	A-4	0	0	100	95-100	85-100	60-100	15-30	NP-10

Table 19.—Engineering Index Properties--(continued)

(The symbol < means less than; > means greater than. Dashes (—) indicate that an assignment has not been made.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number—: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
2213:												
Eckman----------	0-6	Loam	ML	A-4	0	0	100	100	85-100	60-75	18-38	NP-10
	6-37	Silt loam, very fine sandy loam	ML	A-4	0	0	100	100	85-100	55-90	20-40	NP-10
	37-60	Silt loam, very fine sandy loam, fine sandy loam	ML, SM	A-4	0	0	100	100	65-100	40-90	20-40	NP-10
Zell------------	0-7	Loam	CL, CL-ML, ML	A-4	0	0	100	95-100	85-100	80-100	20-30	5-10
	7-29	Silt loam, very fine sandy loam, loam	CL-ML, CL, ML	A-4	0	0	100	95-100	85-100	70-100	20-30	5-10
	29-60	Silt loam, very fine sandy loam, loam	CL, CL-ML, ML	A-4	0	0	100	95-100	85-100	60-100	15-30	NP-10
2214:												
Exline----------	0-1	Loam	CL	A-6, A-7	0	0	100	100	95-100	85-100	30-45	10-20
	1-12	Clay, silty clay, silty clay loam	CH, MH	A-7	0	0	100	100	95-100	90-100	60-90	30-50
	12-35	Silty clay loam, silty clay, clay	CH, MH	A-7	0	0	100	100	95-100	85-100	50-80	20-45
	35-60	Stratified very fine sand to clay	CH, CL	A-7	0	0	100	100	95-100	85-100	40-60	15-30
2215:												
Fairdale--------	0-13	Loam	CL-ML, CL, ML	A-4, A-6	0	0	100	100	85-100	60-90	20-40	3-15
	13-60	Stratified fine sandy loam to loam, stratified very fine sandy loam to silty clay loam	CL-ML, CL, ML	A-4, A-6	0	0	100	100	85-100	55-90	20-40	NP-20
2216:												
Gwinner---------	0-11	Silty clay loam	CL	A-6, A-7	0	0	100	95-100	90-100	80-100	30-45	10-25
	11-21	Silty clay, clay	CH, CL	A-6, A-7	0	0	100	95-100	95-100	90-100	35-55	15-30
	21-27	Clay loam, loam	CL, CL-ML	A-4, A-6	0-1	0-2	90-100	85-100	75-95	55-80	25-40	5-20
	27-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-1	0-2	90-100	85-100	75-95	55-80	25-40	5-20
Peever----------	0-8	Clay loam	CL	A-6, A-7	0	0	100	95-100	90-100	65-90	35-50	12-25
	8-20	Clay, silty clay, clay loam	CL, CH, MH, ML	A-7	0	0	100	95-100	85-100	70-85	40-65	15-30
	20-43	Clay loam, clay	CH, CL, ML, MH	A-7	0	0-5	95-100	90-100	85-100	70-85	40-65	15-30
	43-60	Clay loam, clay	CL, MH, CH, ML	A-7	0	0-5	95-100	90-100	85-100	70-85	40-65	15-30

Table 19.—Engineering Index Properties--(continued)

(The symbol < means less than; > means greater than. Dashes (—) indicate that an assignment has not been made.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number—: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
2216: (con't)												
Parnell----------	0-17	Silty clay loam	CH, CL, OL	A-7	0	0-1	100	100	95-100	85-100	40-55	20-35
	17-60	Clay loam, silty clay loam, silty clay	CH, CL	A-7	0	0-2	95-100	90-100	80-95	70-95	50-60	30-40
2217:												
Hamerly----------	0-8	Loam	CL, CL-ML	A-4, A-6	0	0-5	95-100	90-100	80-95	60-90	20-40	5-20
	8-22	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0	0-5	95-100	90-100	80-95	60-75	20-45	5-25
	22-60	Loam, clay loam	CL, CL-ML	A-6, A-4, A-7	0	0-5	95-100	90-100	75-95	55-75	20-45	5-25
Buse-------------	0-6	Loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-95	70-95	55-90	25-35	10-15
	6-60	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0	0-5	90-100	85-100	70-90	55-85	25-45	10-25
Parnell----------	0-17	Silty clay loam	CH, OL, CL	A-7	0	0-1	100	100	95-100	85-100	40-55	20-35
	17-60	Clay loam, silty clay loam, silty clay	CH, CL	A-7	0	0-2	95-100	90-100	80-95	70-95	50-60	30-40
2218:												
Brantford--------	0-8	Loam	CL, CL-ML	A-4	0	0	90-100	85-95	80-90	60-80	20-30	4-10
	8-15	Loam	CL, CL-ML	A-4, A-6	0	0	90-100	85-95	80-90	60-80	30-35	10-15
	15-60	Stratified very gravelly coarse sand to loamy sand	GP-GM, SM, GM, SP-SM	A-3, A-1, A-2	0	5-25	50-95	30-75	15-60	5-30	15-20	NP-5
Vang-------------	0-9	Loam	CL, CL-ML, ML	A-4, A-6, A-7	0	0	100	100	85-100	60-80	25-45	5-15
	9-27	Loam, clay loam, gravelly loam	CL, ML, SM, SC	A-4, A-7, A-6	0	0	65-100	50-100	40-100	35-80	25-45	5-15
	27-60	Very gravelly sand, extremely gravelly sand, very gravelly loamy sand	GM, SM	A-1, A-2	0-5	5-25	50-95	30-75	15-60	15-30	0-14	NP
2219:												
Hegne------------	0-7	Silty clay loam	CH, CL	A-7	0	0	100	100	90-100	85-95	40-55	20-35
	7-24	Silty clay, clay	CH	A-7	0	0	100	100	95-100	95-98	55-75	35-50
	24-60	Clay, silty clay, silty clay loam	CH	A-7	0	0	100	100	95-100	95-100	55-75	35-50

Table 19.—Engineering Index Properties--(continued)

(The symbol < means less than; > means greater than. Dashes (—) indicate that an assignment has not been made.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
2220:												
Letcher	0-8	Sandy loam, fine sandy loam	SC-SM, SM	A-4	0	0	100	100	60-95	35-50	15-30	NP-7
	8-17	Sandy loam, fine sandy loam, loamy fine sand	SC-SM, SM	A-2, A-4	0	0	100	100	60-95	20-45	15-30	NP-7
	17-24	Loam, sandy loam, fine sandy loam	CL, SM, ML, SC	A-4, A-2, A-6	0	0	100	100	60-95	30-60	25-40	3-18
	24-60	Sandy loam, fine sandy loam, loam	ML, SC, CL, SM	A-2, A-4, A-6	0	0	100	95-100	50-95	30-60	25-40	3-18
Lemert	0-5	Sandy loam	ML, SC-SM, CL-ML, SM	A-2, A-4	0	0	100	100	60-85	30-55	15-25	NP-5
	5-12	Loam, sandy loam, fine sandy loam	ML, CL, SC, SM	A-2, A-4	0	0	100	100	60-85	30-60	15-30	NP-10
	12-27	Loam, sandy loam	ML, SM	A-4	0	0	100	100	70-90	40-60	20-35	NP-10
	27-60	Clay loam, loam, sand	CL, CL-ML, SM	A-2, A-4, A-6	0	0	100	100	50-100	5-80	0-40	NP-20
2221:												
Falsen	0-12	Loamy sand	SM, SP-SM	A-1, A-2	0	0	100	100	45-65	10-25	0-14	NP
	12-25	Coarse sand, loamy coarse sand, loamy sand	SM, SP, SP-SM	A-1, A-3, A-2	0	0	100	100	45-65	10-25	0-14	NP
	25-60	Coarse sand, sand	SP, SM, SP-SM	A-1, A-2, A-3	0	0	95-100	90-100	65-80	2-20	0-14	NP
2222:												
Peever	0-8	Clay loam	CL	A-6, A-7	0	0	100	95-100	90-100	65-90	35-50	12-25
	8-20	Clay, silty clay, clay loam	CL, MH, CH, ML	A-7	0	0	100	95-100	85-100	70-85	40-65	15-30
	20-43	Clay loam, clay	CL, CH, MH, ML	A-7	0	0-5	95-100	90-100	85-100	70-85	40-65	15-30
	43-60	Clay loam, clay	CL, CH, MH, ML	A-7	0	0-5	95-100	90-100	85-100	70-85	40-65	15-30
Gwinner	0-11	Silty clay loam	CL	A-6, A-7	0	0	100	95-100	90-100	80-100	30-45	10-25
	11-21	Silty clay, clay	CH, CL	A-6, A-7	0	0	100	95-100	95-100	90-100	35-55	15-30
	21-27	Clay loam, loam	CL, CL-ML	A-4, A-6	0-1	0-2	90-100	85-100	75-95	55-80	25-40	5-20
	27-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-1	0-2	90-100	85-100	75-95	55-80	25-40	5-20
2223:												
Renshaw	0-7	Loam	ML	A-4	0	0-5	95-100	90-100	70-100	50-75	20-40	NP-10
	7-15	Loam, sandy clay loam, gravelly loam	ML, CL, SC, SC-SM	A-4, A-6	0	0-5	95-100	55-100	45-90	35-70	20-40	3-15
	15-60	Gravelly loamy sand, very gravelly loamy sand, gravelly sand	SM, GW-GM, SW, SW-SM	A-1, A-2	0	0-5	45-95	30-80	10-60	0-15	0-25	NP-5

Table 19.--Engineering Index Properties--(continued)

(The symbol < means less than; > means greater than. Dashes (--) indicate that an assignment has not been made.)

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
2223: (con't)												
Sioux-----------	0-7	Sandy loam	SM	A-4	0	0-5	95-100	85-100	60-85	35-45	20-30	NP-7
	7-60	Extremely gravelly sand, very gravelly loamy sand, very gravelly sand	GP, GM, SM, SP	A-1	0	0-5	25-75	20-60	5-35	0-25	0-25	NP-5
2224:												
Serden----------	0-5	Fine sand	SM	A-2	0	0	100	100	65-85	15-25	---	NP
	5-60	Fine sand, sand	SM, SP-SM	A-2, A-3	0	0	100	100	65-85	5-25	---	NP
Hamar-----------	0-15	Loamy fine sand	SC-SM, SM	A-2, A-4	0	0	100	100	85-100	15-40	0-25	NP-5
	15-23	Loamy fine sand, loamy sand, fine sand	SC-SM, SM, SP-SM	A-2, A-4	0	0	100	100	70-100	10-40	0-25	NP-5
	23-60	Fine sand, loamy sand, loamy fine sand	SC-SM, SM, SP-SM	A-2	0	0	100	100	70-100	10-35	0-25	NP-5
2225:												
Sioux-----------	0-5	Cobbly sandy loam	SC-SM, SP-SM, SM	A-1, A-4, A-2	1-5	15-75	75-100	70-90	25-80	10-40	0-25	NP-7
	5-60	Extremely gravelly sand, very gravelly loamy sand, very gravelly sand	GP, GM, SM, SP	A-1	0	0-15	25-75	10-60	5-35	0-25	0-25	NP-5
2226:												
Stirum----------	0-3	Sandy loam	CL-ML, SM, ML, SC-SM	A-2, A-4	0	0	100	100	60-95	30-60	15-25	NP-5
	3-21	Loam, fine sandy loam, sandy loam	CL, SM, ML, SC	A-2, A-4	0	0	100	100	60-95	30-75	15-30	NP-10
	21-60	Stratified sand to loamy sand, stratified loamy sand to silty clay loam	ML, CL, SC, SM	A-4, A-2, A-6	0	0	100	100	50-100	15-90	0-30	NP-15
Lemert----------	0-5	Sandy loam	CL-ML, SM, ML, SC-SM	A-2, A-4	0	0	100	100	60-85	30-55	15-25	NP-5
	5-12	Loam, sandy loam, fine sandy loam	CL, ML, SM, SC	A-2, A-4	0	0	100	100	60-85	30-60	15-30	NP-10
	12-27	Loam, sandy loam	ML, SM	A-4	0	0	100	100	70-90	40-60	20-35	NP-10
	27-60	Clay loam, loam, sand	CL, CL-ML, SM	A-2, A-4, A-6	0	0	100	100	50-100	5-80	0-40	NP-20

Table 19.—Engineering Index Properties--(continued)

(The symbol < means less than; > means greater than. Dashes (—) indicate that an assignment has not been made.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
2228:												
Aylmer	0-7	Fine sand	SM, SP-SM	A-2, A-3	0	0	100	100	65-100	5-25	0-14	NP
	7-60	Fine sand, sand	SM, SP-SM	A-2, A-3	0	0	100	100	65-100	5-25	0-14	NP
Rosewood	0-14	Fine sandy loam	SC, SC-SM, SM	A-2, A-4	0	0	100	97-100	65-90	30-50	0-30	NP-10
	14-19	Fine sandy loam, loamy fine sand, sandy loam	SC, SC-SM, SM	A-2, A-4	0	0	100	95-100	60-85	25-45	0-30	NP-10
	19-60	Fine sand, sand	SM, SP-SM	A-1, A-2, A-3	0	0	85-100	75-95	45-75	5-25	0-14	NP
Serden	0-5	Fine sand	SM	A-2	0	0	100	100	65-85	15-25	—	NP
	5-60	Fine sand, sand	SM, SP-SM	A-2, A-3	0	0	100	100	65-85	5-25	—	NP

Table 20.--Physical Properties of the Soils

(The symbol < means less than; > means greater than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer. Dashes (--) indicate that data were not available or were not estimated.)

Map symbol and soil name	Depth	Clay	Moist bulk density	Ksat	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
64:												
Arveson----------------	0-7	10-20	1.25-1.40	2.00-6.00	0.13-0.15	Low	5.0-8.0	.17	.17	4	3	86
	7-31	10-27	1.40-1.55	0.60-6.00	0.15-0.17	Low	1.0-5.0	.24	.24			
	31-60	5-20	1.50-1.65	2.00-20	0.05-0.15	Low	0.0-1.0	.17	.17			
76:												
Arvilla----------------	0-8	6-18	1.30-1.50	2.00-6.00	0.13-0.15	Low	1.0-4.0	.20	.20	3	3	86
	8-15	6-18	1.30-1.50	2.00-6.00	0.11-0.14	Low	1.0-2.0	.20	.20			
	15-60	2-10	1.40-1.60	6.00-40	0.02-0.05	Low	0.0-0.5	.05	.15			
86:												
Aylmer-----------------	0-7	3-8	1.30-1.50	6.00-20	0.06-0.12	Low	0.5-1.0	.15	.15	5	1	250
	7-60	3-8	1.40-1.60	6.00-20	0.05-0.07	Low	0.0-0.5	.15	.15			
Bantry-----------------	0-5	2-8	1.30-1.50	6.00-20	0.06-0.12	Low	1.0-3.0	.15	.15	5	1	250
	5-60	1-8	1.40-1.60	6.00-20	0.05-0.07	Low	0.5-1.0	.15	.15			
118:												
Barnes-----------------	0-7	15-27	1.10-1.50	0.60-2.00	0.20-0.22	Low	3.0-6.0	.24	.24	5	6	48
	7-15	18-35	1.20-1.60	0.60-2.00	0.15-0.19	Moderate	2.0-5.0	.28	.28			
	15-28	18-35	1.30-1.60	0.60-2.00	0.15-0.19	Moderate	0.0-1.0	.28	.28			
	28-60	18-35	1.30-1.60	0.20-2.00	0.14-0.19	Moderate	0.0-0.5	.37	.37			
Buse-------------------	0-6	18-27	1.10-1.50	0.20-0.60	0.20-0.24	Low	1.0-3.0	.28	.28	5	4L	86
	6-60	18-35	1.30-1.65	0.20-2.00	0.14-0.19	Moderate	0.0-1.0	.37	.37			
120:												
Barnes-----------------	0-7	15-27	1.10-1.50	0.60-2.00	0.20-0.22	Low	3.0-6.0	.24	.24	5	6	48
	7-15	18-35	1.20-1.60	0.60-2.00	0.15-0.19	Moderate	2.0-5.0	.28	.28			
	15-28	18-35	1.30-1.60	0.60-2.00	0.15-0.19	Moderate	0.0-1.0	.28	.28			
	28-60	18-35	1.30-1.60	0.20-2.00	0.14-0.19	Moderate	0.0-0.5	.37	.37			
Buse-------------------	0-6	18-27	1.10-1.50	0.20-0.60	0.20-0.24	Low	1.0-3.0	.28	.28	5	4L	86
	6-60	18-35	1.30-1.65	0.20-2.00	0.14-0.19	Moderate	0.0-1.0	.37	.37			
154:												
Barnes-----------------	0-7	15-27	1.10-1.50	0.60-2.00	0.20-0.22	Low	3.0-6.0	.24	.24	5	6	48
	7-15	18-35	1.20-1.60	0.60-2.00	0.15-0.19	Moderate	2.0-5.0	.28	.28			
	15-28	18-35	1.30-1.60	0.60-2.00	0.15-0.19	Moderate	0.0-1.0	.28	.28			
	28-60	18-35	1.30-1.60	0.20-2.00	0.14-0.19	Moderate	0.0-0.5	.37	.37			
Svea-------------------	0-12	18-27	1.10-1.30	0.60-2.00	0.20-0.24	Low	4.0-7.0	.28	.32	5	6	48
	12-33	18-35	1.30-1.50	0.20-2.00	0.15-0.22	Moderate	2.0-5.0	.28	.32			
	33-60	18-35	1.30-1.60	0.20-2.00	0.14-0.19	Moderate	0.0-2.0	.37	.43			
156:												
Barnes-----------------	0-7	15-27	1.10-1.50	0.60-2.00	0.20-0.22	Low	3.0-6.0	.24	.24	5	6	48
	7-15	18-35	1.20-1.60	0.60-2.00	0.15-0.19	Moderate	2.0-5.0	.28	.28			
	15-28	18-35	1.30-1.60	0.60-2.00	0.15-0.19	Moderate	0.0-1.0	.28	.28			
	28-60	18-35	1.30-1.60	0.20-2.00	0.14-0.19	Moderate	0.0-0.5	.37	.37			
Svea-------------------	0-12	18-27	1.10-1.30	0.60-2.00	0.20-0.24	Low	4.0-7.0	.28	.32	5	6	48
	12-33	18-35	1.30-1.50	0.20-2.00	0.15-0.22	Moderate	2.0-5.0	.28	.32			
	33-60	18-35	1.30-1.60	0.20-2.00	0.14-0.19	Moderate	0.0-2.0	.37	.43			
314:												
Buse-------------------	0-6	18-27	1.10-1.50	0.20-0.60	0.20-0.24	Low	1.0-3.0	.28	.28	5	4L	86
	6-60	18-35	1.30-1.65	0.20-2.00	0.14-0.19	Moderate	0.0-1.0	.37	.37			

Table 20.--Physical Properties of the Soils--(continued)

(The symbol < means less than; > means greater than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer. Dashes (--) indicate that data were not available or were not estimated.)

Map symbol and soil name	Depth	Clay	Moist bulk density	Ksat	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors Kw	Kf	T	Wind erodibility group	Wind erodibility index
	In	Pct	g/cc	In/hr	In/in		Pct					
314: (con't)												
Barnes	0-7	15-27	1.10-1.50	0.60-2.00	0.20-0.22	Low	3.0-6.0	.24	.24	5	6	48
	7-15	18-35	1.20-1.60	0.60-2.00	0.15-0.19	Moderate	2.0-5.0	.28	.28			
	15-28	18-35	1.30-1.60	0.60-2.00	0.15-0.19	Moderate	0.0-1.0	.28	.28			
	28-60	18-35	1.30-1.60	0.20-2.00	0.14-0.19	Moderate	0.0-0.5	.37	.37			
450:												
Colvin	0-12	18-26	1.15-1.30	0.60-2.00	0.22-0.24	Low	4.0-7.0	.28	.28	5	4L	86
	12-36	18-34	1.20-1.50	0.20-2.00	0.16-0.22	Moderate	1.0-4.0	.43	.43			
	36-60	18-34	1.30-1.50	0.20-2.00	0.16-0.22	Moderate	0.5-1.0	.43	.43			
493:												
Darnen	0-22	18-27	1.10-1.40	0.60-2.00	0.20-0.24	Low	4.0-8.0	.28	.28	5	6	48
	22-31	18-30	1.30-1.50	0.60-2.00	0.15-0.19	Moderate	1.0-4.0	.28	.28			
	31-60	18-30	1.50-1.65	0.60-2.00	0.14-0.19	Moderate	0.5-1.0	.37	.37			
510:												
Divide	0-12	15-27	1.10-1.40	0.60-2.00	0.20-0.24	Low	2.0-7.0	.24	.24	4	4L	86
	12-29	18-35	1.20-1.50	0.60-2.00	0.15-0.19	Moderate	1.0-3.0	.20	.32			
	29-60	1-10	1.45-1.65	6.00-20	0.02-0.07	Low	0.0-1.0	.10	.15			
571:												
Embden	0-12	10-18	1.25-1.35	2.00-6.00	0.13-0.18	Low	4.0-7.0	.20	.20	5	3	86
	12-25	10-18	1.30-1.60	2.00-6.00	0.12-0.17	Low	1.0-4.0	.24	.24			
	25-60	5-18	1.40-1.60	2.00-6.00	0.08-0.16	Low	0.0-1.0	.24	.24			
726:												
Fordville	0-9	18-25	1.20-1.30	0.60-2.00	0.18-0.20	Low	3.0-7.0	.24	.24	4	6	48
	9-23	18-30	1.25-1.40	0.60-2.00	0.18-0.21	Moderate	1.0-3.0	.24	.24			
	23-30	15-30	1.25-1.45	0.60-6.00	0.12-0.18	Low	1.0-3.0	.24	.24			
	30-60	0-5	1.60-1.70	6.00-20	0.03-0.06	Low	0.0-1.0	.10	.17			
772:												
Gardena	0-14	12-18	1.10-1.40	0.60-2.00	0.18-0.20	Low	4.0-8.0	.24	.24	5	5	56
	14-60	10-18	1.20-1.70	0.60-6.00	0.17-0.22	Low	0.0-3.0	.43	.43			
Eckman	0-13	12-18	1.20-1.30	0.60-2.00	0.18-0.20	Low	2.0-6.0	.24	.24	5	5	56
	13-37	10-18	1.20-1.60	0.60-2.00	0.17-0.22	Low	0.0-3.0	.43	.43			
	37-60	10-18	1.20-1.70	0.60-2.00	0.14-0.22	Low	0.0-0.5	.43	.43			
794:												
Glyndon	0-8	15-27	1.20-1.40	0.60-2.00	0.20-0.23	Low	3.0-7.0	.28	.28	5	4L	86
	8-31	10-18	1.30-1.50	0.60-6.00	0.17-0.20	Low	1.0-2.0	.28	.28			
	31-60	5-18	1.35-1.65	2.00-6.00	0.15-0.19	Low	0.0-0.5	.28	.28			
795:												
Glyndon, saline	0-8	15-27	1.20-1.40	0.60-2.00	0.13-0.15	Low	3.0-7.0	.24	.24	5	4L	86
	8-31	10-18	1.30-1.50	2.00-6.00	0.11-0.13	Low	1.0-2.0	.32	.32			
	31-60	5-18	1.35-1.65	2.00-20	0.09-0.12	Low	0.0-0.5	.28	.28			
852:												
Hamar	0-15	5-10	1.20-1.30	2.00-20	0.10-0.12	Low	1.0-3.0	.17	.17	5	2	134
	15-23	0-7	1.35-1.55	2.00-20	0.10-0.12	Low	0.0-2.0	.17	.17			
	23-60	0-7	1.45-1.65	2.00-20	0.06-0.08	Low	0.0-0.5	.17	.17			

Table 20.--Physical Properties of the Soils--(continued)

(The symbol < means less than; > means greater than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer. Dashes (--) indicate that data were not available or were not estimated.)

Map symbol and soil name	Depth	Clay	Moist bulk density	Ksat	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors Kw	Erosion factors Kf	Erosion factors T	Wind erodibility group	Wind erodibility index
	In	Pct	g/cc	In/hr	In/in		Pct					
883:												
Hamerly	0-8	18-27	1.30-1.60	0.60-2.00	0.18-0.24	Moderate	4.0-7.0	.28	.28	5	4L	86
	8-22	18-35	1.30-1.60	0.20-2.00	0.15-0.19	Moderate	1.0-3.0	.28	.28			
	22-60	18-35	1.30-1.60	0.20-2.00	0.15-0.19	Moderate	0.0-0.5	.37	.37			
Tonka	0-19	18-27	1.10-1.30	0.60-2.00	0.20-0.24	Low	5.0-10	.37	.37	5	6	48
	19-34	35-45	1.40-1.65	0.01-0.20	0.14-0.20	High	1.0-3.0	.43	.43			
	34-60	18-39	1.40-1.70	0.20-2.00	0.14-0.19	Moderate	0.0-1.0	.37	.37			
Parnell	0-17	27-40	1.10-1.30	0.20-0.60	0.18-0.22	Moderate	6.0-10	.37	.37	5	7	38
	17-60	35-45	1.30-1.50	0.01-0.20	0.11-0.19	High	0.5-1.0	.28	.28			
939:												
Hecla	0-18	2-10	1.10-1.35	2.00-20	0.10-0.12	Low	1.0-3.0	.17	.17	5	2	134
	18-27	2-10	1.30-1.50	2.00-20	0.06-0.13	Low	1.0-3.0	.17	.17			
	27-60	3-8	1.35-1.60	2.00-20	0.05-0.12	Low	0.0-1.0	.17	.17			
Hamar	0-15	5-10	1.20-1.30	2.00-20	0.10-0.12	Low	1.0-3.0	.17	.17	5	2	134
	15-23	0-7	1.35-1.55	2.00-20	0.10-0.12	Low	0.0-2.0	.17	.17			
	23-60	0-7	1.45-1.65	2.00-20	0.06-0.08	Low	0.0-0.5	.17	.17			
1030:												
Kranzburg	0-9	27-34	1.15-1.25	0.60-2.00	0.19-0.22	Moderate	4.0-8.0	.28	.28	5	7	38
	9-27	24-34	1.20-1.35	0.60-2.00	0.18-0.21	Moderate	1.0-4.0	.32	.32			
	27-39	25-30	1.50-1.70	0.20-0.60	0.18-0.20	Moderate	0.5-2.0	.37	.37			
	39-60	25-30	1.50-1.70	0.20-0.60	0.18-0.20	Moderate	0.0-1.0	.37	.37			
Lismore	0-17	27-30	1.15-1.25	0.60-2.00	0.19-0.22	Moderate	4.0-8.0	.28	.28	5	7	38
	17-27	25-33	1.30-1.45	0.20-0.60	0.18-0.22	Moderate	1.0-3.0	.28	.28			
	27-36	25-30	1.50-1.70	0.20-0.60	0.16-0.18	Moderate	0.5-1.0	.32	.32			
	36-60	25-30	1.50-1.70	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	.37	.37			
1043:												
La Prairie	0-17	18-27	1.10-1.40	0.60-2.00	0.17-0.22	Low	2.0-6.0	.24	.24	5	6	48
	17-35	18-35	1.30-1.70	0.60-2.00	0.15-0.22	Moderate	0.0-2.0	.28	.28			
	35-60	18-30	1.30-1.70	0.60-2.00	0.15-0.22	Moderate	0.0-2.0	.28	.28			
1055:												
LaDelle	0-20	20-27	1.15-1.30	0.60-2.00	0.20-0.22	Low	3.0-7.0	.28	.28	5	6	48
	20-50	25-35	1.20-1.35	0.60-2.00	0.18-0.22	Moderate	0.5-2.0	.32	.32			
	50-60	25-35	1.30-1.40	0.60-2.00	0.18-0.22	Moderate	0.0-0.5	.28	.28			
1081:												
Lamoure	0-10	20-26	1.10-1.25	0.20-2.00	0.19-0.22	Low	4.0-8.0	.28	.28	5	4L	86
	10-26	20-34	1.20-1.35	0.20-2.00	0.17-0.20	Moderate	1.0-3.0	.32	.32			
	26-60	20-34	1.25-1.40	0.20-2.00	0.09-0.18	Moderate	0.0-0.5	.28	.28			
1168:												
Lismore	0-17	27-30	1.15-1.25	0.60-2.00	0.19-0.22	Moderate	4.0-8.0	.28	.28	5	7	38
	17-27	25-33	1.30-1.45	0.20-0.60	0.18-0.22	Moderate	1.0-3.0	.28	.28			
	27-36	25-30	1.50-1.70	0.20-0.60	0.16-0.18	Moderate	0.5-1.0	.32	.32			
	36-60	25-30	1.50-1.70	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	.37	.37			
Kranzburg	0-9	27-34	1.15-1.25	0.60-2.00	0.19-0.22	Moderate	4.0-8.0	.28	.28	5	7	38
	9-27	24-34	1.20-1.35	0.60-2.00	0.18-0.21	Moderate	1.0-4.0	.32	.32			
	27-39	25-30	1.50-1.70	0.20-0.60	0.18-0.20	Moderate	0.5-2.0	.37	.37			
	39-60	25-30	1.50-1.70	0.20-0.60	0.18-0.20	Moderate	0.0-1.0	.37	.37			

Table 20.—Physical Properties of the Soils--(continued)

(The symbol < means less than; > means greater than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer. Dashes (—) indicate that data were not available or were not estimated.)

Map symbol and soil name	Depth	Clay	Moist bulk density	Ksat	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors Kw	Kf	T	Wind erodibility group	Wind erodibility index
	In	Pct	g/cc	In/hr	In/in		Pct					
1205:												
Maddock	0-14	2-10	1.20-1.40	2.00-20	0.10-0.12	Low	1.0-2.0	.17	.17	5	2	134
	14-60	2-8	1.30-1.50	2.00-20	0.05-0.12	Low	0.0-0.5	.17	.17			
1221:												
Maddock	0-14	2-10	1.20-1.40	2.00-20	0.10-0.12	Low	1.0-2.0	.17	.17	5	2	134
	14-60	2-8	1.30-1.50	2.00-20	0.05-0.12	Low	0.0-0.5	.17	.17			
Hecla	0-18	2-10	1.10-1.35	2.00-20	0.10-0.12	Low	1.0-3.0	.17	.17	5	2	134
	18-27	2-10	1.30-1.50	2.00-20	0.06-0.13	Low	1.0-3.0	.17	.17			
	27-60	3-8	1.35-1.60	2.00-20	0.05-0.12	Low	0.0-1.0	.17	.17			
1269:												
Marysland	0-14	18-35	1.10-1.30	0.60-2.00	0.17-0.24	Moderate	5.0-8.0	.28	.28	4	4L	86
	14-22	18-35	1.35-1.50	0.20-2.00	0.15-0.19	Moderate	1.0-3.0	.28	.28			
	22-60	1-5	1.45-1.65	6.00-20	0.02-0.07	Low	0.0-0.5	.10	.10			
1403:												
Overly	0-17	27-35	1.20-1.40	0.20-0.60	0.17-0.23	Moderate	4.0-8.0	.37	.37	5	7	38
	17-56	18-34	1.20-1.50	0.20-0.60	0.17-0.22	Moderate	0.0-1.0	.43	.43			
	56-60	18-35	1.20-1.60	0.01-0.60	0.13-0.22	Moderate	0.0-1.0	.43	.43			
1427:												
Parnell	0-17	27-40	1.10-1.30	0.20-0.60	0.18-0.22	Moderate	6.0-10	.37	.37	5	7	38
	17-60	35-45	1.30-1.50	0.01-0.20	0.11-0.19	High	0.5-1.0	.28	.28			
1466:												
Pits, gravel and sand	0-6	5-15	1.20-1.60	6.00-20	0.01-0.04	Low	0.5-1.0	.10	.20	5	8	0
	6-60	0-15	1.20-1.60	6.00-20	0.01-0.04	Low	0.0-0.5	.10	.17			
1472:												
Rauville	0-40	15-26	0.85-1.10	0.60-2.00	0.19-0.22	Low	4.0-10	.28	.28	5	4L	86
	40-60	20-45	1.10-1.30	0.20-2.00	0.17-0.20	Moderate	1.0-4.0	.32	.32			
1523:												
Renshaw	0-7	10-19	1.20-1.30	0.60-2.00	0.18-0.20	Low	2.0-4.0	.28	.28	3	5	56
	7-15	18-27	1.30-1.45	0.60-6.00	0.11-0.18	Low	0.5-2.0	.28	.43			
	15-60	0-5	1.45-1.65	6.00-20	0.03-0.06	Low	0.0-0.5	.10	.24			
1560:												
Rifle	0-9	—	0.20-0.35	6.00-20	0.55-0.65	—	70-90	—	—	3	5	56
	9-60	—	0.08-0.20	0.60-6.00	0.45-0.55	—	70-90	—	—			
1577:												
Rosewood	0-14	8-18	1.20-1.40	2.00-6.00	0.13-0.18	Low	4.0-7.0	.24	.24	3	3	86
	14-19	6-18	1.20-1.40	2.00-6.00	0.11-0.15	Low	0.0-1.0	.24	.24			
	19-60	1-6	1.45-1.65	6.00-20	0.05-0.08	Low	0.0-0.5	.24	.24			
1648:												
Serden	0-5	3-8	1.30-1.50	6.00-20	0.06-0.12	Low	0.5-1.0	.15	.15	5	1	250
	5-60	3-8	1.40-1.60	6.00-20	0.05-0.07	Low	0.0-0.5	.15	.15			
Duneland	0-6	0-5	1.40-1.60	6.00-20	0.04-0.05	Low	0.0-0.5	.15	.15	5	1	250
	6-60	0-5	1.40-1.60	6.00-20	0.03-0.05	Low	—	.10	.10			

Table 20.—Physical Properties of the Soils--(continued)

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Map symbol and soil name	Depth	Clay	Moist bulk density	Ksat	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors Kw	Kf	T	Wind erodibility group	Wind erodibility index
	In	Pct	g/cc	In/hr	In/in		Pct					
1670:												
Ulen------------------	0-14	8-20	1.30-1.50	2.00-6.00	0.13-0.18	Low	2.0-5.0	.17	.17	5	3	86
	14-30	5-12	1.45-1.65	6.00-20	0.06-0.10	Low	0.0-1.0	.17	.17			
	30-60	1-7	1.50-1.70	6.00-20	0.06-0.08	Low	0.0-0.5	.17	.17			
Rosewood--------------	0-14	8-18	1.20-1.40	2.00-6.00	0.13-0.18	Low	4.0-7.0	.24	.24	3	3	86
	14-19	6-18	1.20-1.40	2.00-6.00	0.11-0.15	Low	0.0-1.0	.24	.24			
	19-60	1-6	1.45-1.65	6.00-20	0.05-0.08	Low	0.0-0.5	.24	.24			
1704:												
Sioux-----------------	0-7	10-18	1.25-1.40	2.00-6.00	0.11-0.15	Low	1.0-3.0	.20	.20	2	3	86
	7-60	0-10	1.60-1.70	6.00-60	0.03-0.06	Low	0.0-0.5	.10	.15			
Renshaw---------------	0-7	10-19	1.20-1.30	0.60-2.00	0.18-0.20	Low	2.0-4.0	.28	.28	3	5	56
	7-15	18-27	1.30-1.45	0.60-6.00	0.11-0.18	Low	0.5-2.0	.28	.43			
	15-60	0-5	1.45-1.65	6.00-20	0.03-0.06	Low	0.0-0.5	.10	.24			
1709:												
Southam---------------	0-8	15-26	1.10-1.40	0.20-2.00	0.22-0.24	Low	5.0-15	.37	.37	5	4L	86
	8-33	35-50	1.20-1.50	0.01-0.20	0.14-0.20	High	1.0-10	.28	.28			
	33-60	18-50	1.20-1.50	0.01-0.60	0.13-0.17	High	0.0-3.0	.28	.28			
1772:												
Svea------------------	0-12	18-27	1.10-1.30	0.60-2.00	0.20-0.24	Low	4.0-7.0	.28	.32	5	6	48
	12-33	18-35	1.30-1.50	0.20-2.00	0.15-0.22	Moderate	2.0-5.0	.28	.32			
	33-60	18-35	1.30-1.60	0.20-2.00	0.14-0.19	Moderate	0.0-2.0	.37	.43			
Gardena---------------	0-14	12-18	1.10-1.40	0.60-2.00	0.18-0.20	Low	4.0-8.0	.24	.24	5	6	56
	14-60	10-18	1.20-1.70	0.60-6.00	0.17-0.22	Low	0.0-3.0	.43	.43			
1788:												
Swenoda---------------	0-8	10-20	1.10-1.35	2.00-6.00	0.13-0.18	Low	3.0-7.0	.20	.20	5	3	86
	8-29	10-18	1.30-1.45	2.00-6.00	0.10-0.17	Low	1.0-3.0	.20	.20			
	29-60	20-35	1.35-1.65	0.20-2.00	0.16-0.22	Moderate	0.0-1.0	.37	.37			
Barnes----------------	0-7	15-27	1.10-1.50	0.60-2.00	0.20-0.22	Low	3.0-6.0	.24	.24	5	6	48
	7-15	18-35	1.20-1.60	0.60-2.00	0.15-0.19	Moderate	2.0-5.0	.28	.28			
	15-28	18-35	1.30-1.60	0.60-2.00	0.15-0.19	Moderate	0.0-1.0	.28	.28			
	28-60	18-35	1.30-1.60	0.20-2.00	0.14-0.19	Moderate	0.0-0.5	.37	.37			
1834:												
Tonka-----------------	0-19	18-27	1.10-1.30	0.60-2.00	0.20-0.24	Low	5.0-10	.37	.37	5	6	48
	19-34	35-45	1.40-1.65	0.01-0.20	0.14-0.20	High	1.0-3.0	.43	.43			
	34-60	18-39	1.40-1.70	0.20-2.00	0.14-0.19	Moderate	0.0-1.0	.37	.37			
1842:												
Towner----------------	0-20	2-10	1.20-1.40	6.00-20	0.08-0.12	Low	1.0-3.0	.17	.17	5	2	134
	20-29	2-10	1.20-1.40	6.00-20	0.06-0.13	Low	0.0-1.0	.17	.17			
	29-60	18-40	1.30-1.60	0.20-2.00	0.14-0.22	Moderate	0.0-0.5	.43	.43			
1859:												
Ulen------------------	0-14	8-20	1.30-1.50	2.00-6.00	0.13-0.18	Low	2.0-5.0	.17	.17	5	3	86
	14-30	5-12	1.45-1.65	6.00-20	0.06-0.10	Low	0.0-1.0	.17	.17			
	30-60	1-7	1.50-1.70	6.00-20	0.06-0.08	Low	0.0-0.5	.17	.17			

Table 20.—Physical Properties of the Soils--(continued)

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Map symbol and soil name	Depth	Clay	Moist bulk density	Ksat	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors Kw	Kf	T	Wind erodibility group	Wind erodibility index
	In	Pct	g/cc	In/hr	In/in		Pct					
1871:												
Vallers, saline	0-12	18-27	1.10-1.40	0.60-2.00	0.14-0.16	Low	5.0-8.0	.24	.24	5	4L	86
	12-38	18-35	1.30-1.50	0.20-2.00	0.10-0.13	Moderate	1.0-3.0	.28	.28			
	38-60	18-35	1.30-1.60	0.20-2.00	0.11-0.13	Moderate	0.0-1.0	.37	.37			
1883:												
Vallers	0-12	18-27	1.20-1.35	0.60-2.00	0.22-0.24	Low	5.0-8.0	.28	.28	5	4L	86
	12-38	18-35	1.40-1.55	0.20-0.60	0.15-0.19	Moderate	1.0-3.0	.28	.28			
	38-60	18-35	1.50-1.70	0.20-0.60	0.17-0.19	Low	0.0-1.0	.28	.28			
Parnell	0-17	27-40	1.10-1.30	0.20-0.60	0.18-0.22	Moderate	6.0-10	.37	.37	5	7	38
	17-60	35-45	1.30-1.50	0.01-0.20	0.11-0.19	High	0.5-1.0	.28	.28			
1935:												
Venlo	0-13	5-10	1.20-1.30	6.00-20	0.13-0.18	Low	2.0-5.0	.20	.20	5	3	86
	13-60	0-7	1.40-1.70	6.00-20	0.05-0.12	Low	0.0-0.5	.15	.15			
1953:												
Wahpeton	0-19	40-59	1.10-1.30	0.20-2.00	0.14-0.18	High	4.0-8.0	.28	.28	5	4	86
	19-60	35-59	1.10-1.40	0.20-2.00	0.13-0.17	High	0.0-2.0	.28	.28			
1978:												
Water	—	—	—	—	—	—	—	—	—	—	—	—
2049:												
Wyndmere	0-9	5-15	1.10-1.30	0.60-2.00	0.20-0.24	Low	5.0-8.0	.24	.24	5	4L	86
	9-27	3-15	1.30-1.50	2.00-6.00	0.12-0.17	Low	1.0-5.0	.24	.24			
	27-60	3-15	1.30-1.70	2.00-20	0.05-0.16	Low	0.0-1.0	.24	.24			
2091:												
Zell	0-7	10-18	1.15-1.30	0.60-2.00	0.20-0.24	Low	2.0-4.0	.32	.32	5	4L	86
	7-29	10-18	1.30-1.35	0.60-2.00	0.16-0.22	Low	0.5-2.0	.43	.43			
	29-60	5-18	1.30-1.50	0.60-2.00	0.15-0.22	Low	0.0-0.5	.43	.43			
2206:												
Barnes	0-7	15-27	1.10-1.50	0.60-2.00	0.20-0.22	Low	3.0-6.0	.24	.24	5	6	48
	7-15	18-35	1.20-1.60	0.60-2.00	0.15-0.19	Moderate	2.0-5.0	.28	.28			
	15-28	18-35	1.30-1.60	0.60-2.00	0.15-0.19	Moderate	0.0-1.0	.28	.28			
	28-60	18-35	1.30-1.60	0.20-2.00	0.14-0.19	Moderate	0.0-0.5	.37	.37			
Sioux	0-7	10-18	1.25-1.40	2.00-6.00	0.11-0.15	Low	1.0-3.0	.20	.20	2	3	86
	7-60	0-10	1.60-1.70	6.00-59.94	0.03-0.06	Low	0.0-0.5	.10	.15			
2207:												
Bearden	0-9	18-26	1.20-1.40	0.60-2.00	0.17-0.23	Moderate	3.0-7.0	.28	.28	5	4L	86
	9-43	18-34	1.30-1.50	0.20-2.00	0.16-0.22	Moderate	0.0-5.0	.28	.28			
	43-60	2-10	1.30-1.60	6.00-20	0.05-0.09	Low	0.0-1.0	.15	.15			
2208:												
Brantford	0-9	10-19	1.10-1.30	0.60-2.00	0.20-0.22	Low	3.0-6.0	.28	.32	3	5	56
	9-16	18-27	1.25-1.40	0.60-2.00	0.17-0.19	Low	1.0-3.0	.28	.32			
	16-60	2-8	1.35-1.65	6.00-20	0.02-0.04	Low	0.0-0.5	.10	.43			
Coe	0-7	6-18	1.25-1.35	2.00-6.00	0.13-0.15	Low	2.0-4.0	.20	.20	2	3	86
	7-60	2-8	1.35-1.65	6.00-20	0.02-0.04	Low	0.0-0.5	.10	.43			

Table 20.--Physical Properties of the Soils--(continued)

(The symbol < means less than; > means greater than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer. Dashes (--) indicate that data were not available or were not estimated.)

Map symbol and soil name	Depth	Clay	Moist bulk density	Ksat	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors Kw	Erosion factors Kf	Erosion factors T	Wind erodibility group	Wind erodibility index
	In	Pct	g/cc	In/hr	In/in		Pct					
2209:												
Buse	0-6	18-27	1.10-1.50	0.20-0.60	0.20-0.24	Low	1.0-3.0	.28	.28	5	4L	86
	6-60	18-35	1.30-1.65	0.20-2.00	0.14-0.19	Moderate	0.0-1.0	.37	.37			
Barnes	0-7	15-27	1.10-1.50	0.60-2.00	0.20-0.22	Low	3.0-6.0	.24	.24	5	6	48
	7-15	18-35	1.20-1.60	0.60-2.00	0.15-0.19	Moderate	2.0-5.0	.28	.28			
	15-28	18-35	1.30-1.60	0.60-2.00	0.15-0.19	Moderate	0.0-1.0	.28	.28			
	28-60	18-35	1.30-1.60	0.20-2.00	0.14-0.19	Moderate	0.0-0.5	.37	.37			
2210:												
Cathay	0-14	10-27	1.10-1.40	0.60-2.00	0.20-0.23	Low	2.0-5.0	.32	.64	5	5	56
	14-21	18-35	1.40-1.60	0.01-0.60	0.16-0.19	Moderate	0.5-2.0	.32	.64			
	21-60	7-18	1.40-1.60	0.20-2.00	0.17-0.19	Moderate	0.0-0.5	.32	.64			
Larson	0-10	10-27	1.10-1.40	0.60-2.00	0.16-0.22	Moderate	2.0-5.0	.32	.64	2	5	56
	10-22	18-35	1.30-1.60	0.01-0.20	0.10-0.14	Moderate	1.0-2.0	.32	.64			
	22-60	10-35	1.30-1.60	0.20-2.00	0.12-0.16	Moderate	0.0-0.5	.32	.64			
2211:												
Eckman	0-6	12-18	1.20-1.30	0.60-2.00	0.18-0.20	Low	2.0-6.0	.24	.24	5	5	56
	6-37	10-18	1.20-1.60	0.60-2.00	0.17-0.22	Low	0.0-3.0	.43	.43			
	37-60	10-18	1.20-1.70	0.60-2.00	0.14-0.22	Low	0.0-0.5	.43	.43			
Gardena	0-14	12-18	1.10-1.40	0.60-2.00	0.18-0.20	Low	4.0-8.0	.24	.24	5	5	56
	14-60	10-18	1.20-1.70	0.60-6.00	0.17-0.22	Low	0.0-3.0	.43	.43			
2212:												
Eckman	0-6	12-18	1.20-1.30	0.60-2.00	0.18-0.20	Low	2.0-6.0	.24	.24	5	5	56
	6-37	10-18	1.20-1.60	0.60-2.00	0.17-0.22	Low	0.0-3.0	.43	.43			
	37-60	10-18	1.20-1.70	0.60-2.00	0.14-0.22	Low	0.0-0.5	.43	.43			
Zell	0-7	10-18	1.15-1.30	0.60-2.00	0.20-0.24	Low	2.0-4.0	.32	.32	5	4L	86
	7-29	10-18	1.30-1.35	0.60-2.00	0.16-0.22	Low	0.5-2.0	.43	.43			
	29-60	5-18	1.30-1.50	0.60-2.00	0.15-0.22	Low	0.0-0.5	.43	.43			
2213:												
Eckman	0-6	12-18	1.20-1.30	0.60-2.00	0.18-0.20	Low	2.0-6.0	.24	.24	5	5	56
	6-37	10-18	1.20-1.60	0.60-2.00	0.17-0.22	Low	0.0-3.0	.43	.43			
	37-60	10-18	1.20-1.70	0.60-2.00	0.14-0.22	Low	0.0-0.5	.43	.43			
Zell	0-7	10-18	1.15-1.30	0.60-2.00	0.20-0.24	Low	2.0-4.0	.32	.32	5	4L	86
	7-29	10-18	1.30-1.35	0.60-2.00	0.16-0.22	Low	0.5-2.0	.43	.43			
	29-60	5-18	1.30-1.50	0.60-2.00	0.15-0.22	Low	0.0-0.5	.43	.43			
2214:												
Exline	0-1	20-26	1.25-1.30	0.60-2.00	0.19-0.22	Low	1.0-3.0	.37	.37	2	6	48
	1-12	35-55	1.25-1.40	0.01-0.01	0.10-0.15	High	0.0-2.0	.28	.28			
	12-35	35-50	1.25-1.40	0.01-0.20	0.14-0.17	High	0.0-1.0	.43	.43			
	35-60	25-35	1.25-1.40	0.01-0.20	0.14-0.17	Moderate	0.0-0.5	.43	.43			
2215:												
Fairdale	0-13	18-27	1.20-1.40	0.60-2.00	0.20-0.24	Low	3.0-7.0	.24	.24	5	4L	86
	13-60	18-35	1.20-1.50	0.60-2.00	0.17-0.23	Moderate	0.0-3.0	.32	.32			

Table 20.--Physical Properties of the Soils--(continued)

(The symbol < means less than; > means greater than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer. Dashes (--) indicate that data were not available or were not estimated.)

Map symbol and soil name	Depth	Clay	Moist bulk density	Ksat	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors Kw	Erosion factors Kf	Erosion factors T	Wind erodibility group	Wind erodibility index
	In	Pct	g/cc	In/hr	In/in		Pct					
2216:												
Gwinner	0-11	27-39	1.20-1.40	0.20-0.60	0.17-0.23	Moderate	4.0-8.0	.28	.28	5	7	38
	11-21	35-50	1.20-1.50	0.01-0.60	0.15-0.18	High	1.0-3.0	.32	.32			
	21-27	18-35	1.20-1.50	0.20-0.60	0.14-0.19	Moderate	0.0-1.0	.32	.37			
	27-60	18-35	1.20-1.50	0.20-0.60	0.14-0.19	Moderate	0.0-1.0	.32	.37			
Peever	0-8	27-35	1.25-1.35	0.20-0.60	0.17-0.19	Moderate	3.0-6.0	.32	.32	5	6	48
	8-20	35-50	1.25-1.40	0.01-0.60	0.14-0.20	High	1.0-4.0	.37	.37			
	20-43	30-45	1.50-1.70	0.01-0.60	0.13-0.20	High	0.0-1.0	.37	.37			
	43-60	30-45	1.50-1.70	0.01-0.60	0.13-0.20	High	0.0-0.5	.37	.37			
Parnell	0-17	27-40	1.10-1.30	0.20-0.60	0.18-0.22	Moderate	6.0-10	.37	.37	5	7	38
	17-60	35-45	1.30-1.50	0.01-0.20	0.11-0.19	High	0.5-1.0	.28	.28			
2217:												
Hamerly	0-8	18-27	1.30-1.60	0.60-2.00	0.18-0.24	Moderate	4.0-7.0	.28	.28	5	4L	86
	8-22	18-35	1.30-1.60	0.20-2.00	0.15-0.19	Moderate	1.0-3.0	.28	.28			
	22-60	18-35	1.30-1.60	0.20-2.00	0.15-0.19	Moderate	0.0-0.5	.37	.37			
Buse	0-6	18-27	1.10-1.50	0.20-0.60	0.20-0.24	Low	1.0-3.0	.28	.28	5	4L	86
	6-60	18-35	1.30-1.65	0.20-2.00	0.14-0.19	Moderate	0.0-1.0	.37	.37			
Parnell	0-17	27-40	1.10-1.30	0.20-0.60	0.18-0.22	Moderate	6.0-10	.37	.37	5	7	38
	17-60	35-45	1.30-1.50	0.01-0.20	0.11-0.19	High	0.5-1.0	.28	.28			
2218:												
Brantford	0-8	10-19	1.10-1.30	0.60-2.00	0.20-0.22	Low	3.0-6.0	.28	.32	3	5	56
	8-15	18-27	1.25-1.40	0.60-2.00	0.17-0.19	Low	1.0-3.0	.28	.32			
	15-60	2-8	1.35-1.65	6.00-20	0.02-0.04	Low	0.0-0.5	.10	.43			
Vang	0-9	18-27	1.10-1.40	0.60-2.00	0.17-0.21	Low	3.0-8.0	.28	.28	4	6	48
	9-27	18-30	1.20-1.50	0.60-2.00	0.15-0.19	Low	0.5-1.0	.28	.43			
	27-60	0-5	1.40-1.65	6.00-20	0.02-0.04	Low	0.0-1.0	.10	.32			
2219:												
Hegne	0-7	27-39	1.05-1.30	0.20-0.60	0.17-0.23	High	4.0-8.0	.28	.28	5	4L	86
	7-24	40-60	1.30-1.35	0.01-0.20	0.14-0.17	V.High	1.0-4.0	.28	.28			
	24-60	40-60	1.30-1.50	0.01-0.20	0.13-0.20	V.High	0.0-1.0	.28	.28			
2220:												
Letcher	0-8	5-10	1.25-1.35	0.60-2.00	0.11-0.17	Low	2.0-4.0	.20	.20	2	3	86
	8-17	10-18	1.25-1.35	0.60-6.00	0.10-0.15	Low	0.5-2.0	.20	.20			
	17-24	10-15	1.25-1.35	0.01-0.20	0.08-0.14	Low	0.5-2.0	.20	.20			
	24-60	10-15	1.30-1.45	0.60-6.00	0.11-0.18	Low	0.0-0.5	.24	.24			
Lemert	0-5	10-18	1.25-1.35	0.01-0.60	0.13-0.18	Low	1.0-4.0	.32	.32	2	3	86
	5-12	10-18	1.30-1.50	0.01-0.20	0.13-0.18	Low	1.0-2.0	.32	.32			
	12-27	10-18	1.30-1.50	0.60-2.00	0.13-0.20	Low	0.0-1.0	.32	.32			
	27-60	0-35	1.30-1.60	0.20-2.00	0.03-0.19	Moderate	0.0-0.5	.32	.32			
2221:												
Falsen	0-12	5-15	1.50-1.70	6.00-20	0.08-0.10	Low	1.0-3.0	.15	.15	5	2	134
	12-25	5-15	1.50-1.70	6.00-20	0.08-0.10	Low	0.0-0.5	.15	.15			
	25-60	0-10	1.50-1.70	6.00-20	0.03-0.07	Low	0.0-0.5	.15	.15			

Table 20.—Physical Properties of the Soils--(continued)

(The symbol < means less than; > means greater than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer. Dashes (—) indicate that data were not available or were not estimated.)

Map symbol and soil name	Depth	Clay	Moist bulk density	Ksat	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors Kw	Kf	T	Wind erodibility group	Wind erodibility index
	In	Pct	g/cc	In/hr	In/in		Pct					
2222:												
Peever	0-8	27-35	1.25-1.35	0.20-0.60	0.17-0.19	Moderate	3.0-6.0	.32	.32	5	6	48
	8-20	35-50	1.25-1.40	0.01-0.60	0.14-0.20	High	1.0-4.0	.37	.37			
	20-43	30-45	1.50-1.70	0.01-0.60	0.13-0.20	High	0.0-1.0	.37	.37			
	43-60	30-45	1.50-1.70	0.01-0.60	0.13-0.20	High	0.0-0.5	.37	.37			
Gwinner	0-11	27-39	1.20-1.40	0.20-0.60	0.17-0.23	Moderate	4.0-8.0	.28	.28	5	7	38
	11-21	35-50	1.20-1.50	0.01-0.60	0.15-0.18	High	1.0-3.0	.32	.32			
	21-27	18-35	1.20-1.50	0.20-0.60	0.14-0.19	Moderate	0.0-1.0	.32	.37			
	27-60	18-35	1.20-1.50	0.20-0.60	0.14-0.19	Moderate	0.0-1.0	.32	.37			
2223:												
Renshaw	0-7	10-19	1.20-1.30	0.60-2.00	0.18-0.20	Low	2.0-4.0	.28	.28	3	5	56
	7-15	18-27	1.30-1.45	0.60-6.00	0.11-0.18	Low	0.5-2.0	.28	.43			
	15-60	0-5	1.45-1.65	6.00-20	0.03-0.06	Low	0.0-0.5	.10	.24			
Sioux	0-7	10-18	1.25-1.40	2.00-6.00	0.11-0.15	Low	1.0-3.0	.20	.20	2	3	86
	7-60	0-10	1.60-1.70	6.00-60	0.03-0.06	Low	0.0-0.5	.10	.15			
2224:												
Serden	0-5	3-8	1.30-1.50	6.00-20	0.06-0.12	Low	0.5-1.0	.15	.15	5	1	250
	5-60	3-8	1.40-1.60	6.00-20	0.05-0.07	Low	0.0-0.5	.15	.15			
Hamar	0-15	5-10	1.20-1.30	2.00-20	0.10-0.12	Low	1.0-3.0	.17	.17	5	2	134
	15-23	0-7	1.35-1.55	2.00-20	0.10-0.12	Low	0.0-2.0	.17	.17			
	23-60	0-7	1.45-1.65	2.00-20	0.06-0.08	Low	0.0-0.5	.17	.17			
2225:												
Sioux	0-5	2-18	1.45-1.60	2.00-20	0.07-0.12	Low	1.0-3.0	.15	.20	2	8	0
	5-60	0-10	1.50-1.70	6.00-60	0.03-0.06	Low	0.0-0.5	.10	.15			
2226:												
Stirum	0-3	10-20	1.40-1.50	2.00-6.00	0.10-0.13	Low	3.0-5.0	.20	.20	2	3	86
	3-21	10-25	1.40-1.60	0.06-0.60	0.12-0.18	Low	0.5-2.0	.24	.24			
	21-60	5-20	1.40-1.50	0.60-20	0.06-0.18	Low	0.0-0.5	.17	.17			
Lemert	0-5	10-18	1.25-1.35	0.01-0.60	0.13-0.18	Low	1.0-4.0	.32	.32	2	3	86
	5-12	10-18	1.30-1.50	0.01-0.20	0.13-0.18	Low	1.0-2.0	.32	.32			
	12-27	10-18	1.30-1.50	0.60-2.00	0.13-0.20	Low	0.0-1.0	.32	.32			
	27-60	0-35	1.30-1.60	0.20-2.00	0.03-0.19	Moderate	0.0-0.5	.32	.32			
2228:												
Aylmer	0-7	3-8	1.30-1.50	6.00-20	0.06-0.12	Low	0.5-1.0	.15	.15	5	1	250
	7-60	3-8	1.40-1.60	6.00-20	0.05-0.07	Low	0.0-0.5	.15	.15			
Rosewood	0-14	8-18	1.20-1.40	2.00-6.00	0.13-0.18	Low	4.0-7.0	.24	.24	3	3	86
	14-19	6-18	1.20-1.40	2.00-6.00	0.11-0.15	Low	0.0-1.0	.24	.24			
	19-60	1-6	1.45-1.65	6.00-20	0.05-0.08	Low	0.0-0.5	.24	.24			
Serden	0-5	3-8	1.30-1.50	6.00-20	0.06-0.12	Low	0.5-1.0	.15	.15	5	1	250
	5-60	3-8	1.40-1.60	6.00-20	0.05-0.07	Low	0.0-0.5	.15	.15			

Table 21.—Chemical Properties of the Soils

(Dashes (—) indicate that data were not available or were not estimated.)

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
64:								
Arveson	0-7	10-20	15-30	7.4-8.4	10-20	—	0	0
	7-31	10-27	5-25	7.4-8.4	15-30	—	0	0
	31-60	5-20	2-15	7.4-8.4	10-20	—	0	0-1
76:								
Arvilla	0-8	6-18	5-20	6.1-8.4	0	0	0	0
	8-15	6-18	5-15	6.6-8.4	0	0	0	0
	15-60	2-10	1-5	7.4-8.4	1-5	0	0	0
86:								
Aylmer	0-7	3-8	5-10	6.6-7.3	0	—	0	0
	7-60	3-8	1-5	6.1-8.4	0-5	—	0	0
Bantry	0-5	2-8	1-10	6.1-7.8	0	—	0	0
	5-60	1-8	1-5	6.1-8.4	0-5	—	0	0-2
118:								
Barnes	0-7	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	7-15	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	15-28	18-35	5-25	—	0-3	0	0.0-4.0	0
	28-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
Buse	0-6	18-27	10-30	6.6-8.4	1-10	0	0	0
	6-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
120:								
Barnes	0-7	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	7-15	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	15-28	18-35	5-25	—	0-3	0	0.0-4.0	0
	28-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
Buse	0-6	18-27	10-30	6.6-8.4	1-10	0	0	0
	6-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
154:								
Barnes	0-7	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	7-15	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	15-28	18-35	5-25	—	0-3	0	0.0-4.0	0
	28-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
Svea	0-12	18-27	15-30	6.1-7.8	0	0	0	0
	12-33	18-35	10-30	6.6-7.8	0-3	0	0	0
	33-60	18-35	10-25	7.4-8.4	3-15	0-1	0.0-4.0	0-2
156:								
Barnes	0-7	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	7-15	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	15-28	18-35	5-25	—	0-3	0	0.0-4.0	0
	28-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
Svea	0-12	18-27	15-30	6.1-7.8	0	0	0	0
	12-33	18-35	10-30	6.6-7.8	0-3	0	0	0
	33-60	18-35	10-25	7.4-8.4	3-15	0-1	0.0-4.0	0-2

Table 21.--Chemical Properties of the Soils--(continued)

(Dashes (--) indicate that data were not available or were not estimated.)

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
314:								
Buse	0-6	18-27	10-30	6.6-8.4	1-10	0	0	0
	6-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
Barnes	0-7	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	7-15	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	15-28	18-35	5-25	--	0-3	0	0.0-4.0	0
	28-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
450:								
Colvin	0-12	18-26	15-30	6.6-8.4	0-10	0-1	0.0-4.0	0-2
	12-36	18-34	5-30	7.4-8.4	10-45	0-1	0.0-4.0	0-3
	36-60	18-34	5-20	7.4-8.4	5-20	0-5	0.0-4.0	0-10
493:								
Darnen	0-22	18-27	15-35	6.6-7.8	0	0	0	0
	22-31	18-30	10-25	6.1-7.8	0-3	0	0	0
	31-60	18-30	10-25	7.4-8.4	5-30	0	0	0
510:								
Divide	0-12	15-27	10-30	7.4-8.4	1-15	0	0	0
	12-29	18-35	10-30	7.4-8.4	15-35	0-1	0.0-2.0	0
	29-60	1-10	2-10	7.4-8.4	10-30	0	0	0
571:								
Embden	0-12	10-18	10-25	6.6-7.3	0	0	0	0
	12-25	10-18	5-20	6.6-7.8	0	0	0	0
	25-60	5-18	2-15	6.6-8.4	0-15	0	0.0-2.0	0
726:								
Fordville	0-9	18-25	15-30	6.1-7.3	0	--	0.0-2.0	0
	9-23	18-30	10-25	6.1-7.8	0	--	0.0-2.0	0
	23-30	15-30	10-25	6.1-8.4	5-25	--	0.0-2.0	0
	30-60	0-5	0-5	7.4-8.4	5-20	--	0.0-2.0	0-5
772:								
Gardena	0-14	12-18	10-25	6.6-7.8	0	0	0	0
	14-60	10-18	5-15	7.4-8.4	0-15	0-2	0.0-2.0	0-2
Eckman	0-13	12-18	10-20	6.6-7.8	0	0	0	0
	13-37	10-18	5-20	6.6-8.4	0-10	0	0	0
	37-60	10-18	5-20	7.4-8.4	0-15	0	0	0
794:								
Glyndon	0-8	15-27	15-25	7.4-8.4	3-15	--	0.0-4.0	0
	8-31	10-18	5-15	7.4-8.4	15-30	0-1	0.0-4.0	0
	31-60	5-18	5-15	7.4-8.4	5-25	0-1	0.0-4.0	0-2
795:								
Glyndon, saline	0-8	15-27	15-25	7.4-9.0	3-15	0	4.0-16.0	0
	8-31	10-18	5-15	7.9-9.0	15-30	0-1	4.0-16.0	0
	31-60	5-18	5-15	7.9-8.4	5-25	0-1	4.0-16.0	0
852:								
Hamar	0-15	5-10	7-12	6.1-7.8	0	0	0.0-2.0	0
	15-23	0-7	3-9	6.6-8.4	0-1	0	0.0-2.0	0
	23-60	0-7	3-9	7.4-8.4	0-2	0	0.0-2.0	0

Table 21.--Chemical Properties of the Soils--(continued)

(Dashes (--) indicate that data were not available or were not estimated.)

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
883:								
Hamerly	0-8	18-27	15-30	6.6-8.4	1-10	0	0.0-2.0	0
	8-22	18-35	10-20	7.4-8.4	10-30	0-2	0.0-4.0	0-2
	22-60	18-35	10-20	7.4-8.4	5-25	0-2	0.0-4.0	0-2
Tonka	0-19	18-27	20-40	5.6-7.8	0	0	0	0
	19-34	35-45	25-40	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	34-60	18-39	10-35	6.6-8.4	5-20	0-2	0.0-4.0	0-2
Parnell	0-17	27-40	30-50	6.1-7.8	0	0	0	0
	17-60	35-45	20-40	6.6-8.4	0-3	0-2	0	0
939:								
Hecla	0-18	2-10	3-10	6.1-7.8	0-3	0	0	0
	18-27	2-10	3-10	6.1-7.8	0-3	0	0	0
	27-60	3-8	1-8	6.1-8.4	0-10	0	0	0
Hamar	0-15	5-10	7-12	6.1-7.8	0	0	0.0-2.0	0
	15-23	0-7	3-9	6.6-8.4	0-1	0	0.0-2.0	0
	23-60	0-7	3-9	7.4-8.4	0-2	0	0.0-2.0	0
1030:								
Kranzburg	0-9	27-34	20-34	5.6-7.3	0	0	0.0-2.0	0
	9-27	24-34	13-25	6.6-7.8	0-5	0	0.0-2.0	0
	27-39	25-30	12-21	7.4-8.4	10-25	0-2	0.0-4.0	0-2
	39-60	25-30	12-21	7.4-9.0	10-30	0-2	0.0-8.0	0-2
Lismore	0-17	27-30	19-31	6.1-7.3	0	0	0.0-2.0	0
	17-27	25-33	14-23	6.6-7.8	0-5	0	0.0-4.0	0
	27-36	25-30	12-19	7.4-8.4	3-25	0	0.0-4.0	0-1
	36-60	25-30	11-18	7.4-8.4	5-30	0-2	0.0-8.0	0-2
1043:								
La Prairie	0-17	18-27	20-35	6.6-7.8	0-1	0-1	0.0-2.0	0
	17-35	18-35	20-25	6.6-8.4	10-30	0-1	0.0-2.0	0
	35-60	18-30	20-25	6.6-8.4	10-30	0-1	0.0-2.0	0-2
1055:								
LaDelle	0-20	20-27	20-28	6.6-7.8	0-1	0	0	0
	20-50	25-35	20-30	7.4-8.4	4-15	0	0.0-4.0	0
	50-60	25-35	15-25	7.4-8.4	4-15	0	0.0-4.0	0-2
1081:								
Lamoure	0-10	20-26	22-29	7.4-8.4	0-10	0	0.0-4.0	1-2
	10-26	20-34	24-31	7.4-8.4	9-20	0	0.0-4.0	1-3
	26-60	20-34	16-23	7.4-8.4	4-20	0-2	0.0-4.0	1-3
1168:								
Lismore	0-17	27-30	19-31	6.1-7.3	0	0	0.0-2.0	0
	17-27	25-33	14-23	6.6-7.8	1-10	0	0.0-4.0	0
	27-36	25-30	12-19	7.4-8.4	3-25	0	0.0-4.0	0-1
	36-60	25-30	11-18	7.4-8.4	5-30	0-2	0.0-8.0	0-2
Kranzburg	0-9	27-34	20-34	5.6-7.3	0	0	0.0-2.0	0
	9-27	24-34	13-25	6.6-7.8	0-5	0	0.0-2.0	0
	27-39	25-30	12-21	7.4-8.4	10-25	0-2	0.0-4.0	0-2
	39-60	25-30	12-21	7.4-9.0	10-30	0-2	0.0-8.0	0-2

Table 21.—Chemical Properties of the Soils--(continued)

(Dashes (—) indicate that data were not available or were not estimated.)

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorp- tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
1205:								
Maddock	0-14	2-10	3-10	6.6-7.8	0-3	0	0	0
	14-60	2-8	1-8	6.6-8.4	0-10	0	0.0-2.0	0
1221:								
Maddock	0-14	2-10	3-10	6.6-7.8	0-3	0	0	0
	14-60	2-8	1-8	6.6-8.4	0-10	0	0.0-2.0	0
Hecla	0-18	2-10	3-10	6.1-7.8	0-3	0	0	0
	18-27	2-10	3-10	6.1-7.8	0-3	0	0	0
	27-60	3-8	1-8	6.1-8.4	0-10	0	0	0
1269:								
Marysland	0-14	18-35	15-35	7.9-8.4	1-15	0	0	0
	14-22	18-35	10-25	7.9-8.4	15-35	0-3	0.0-2.0	0
	22-60	1-5	2-10	7.9-8.4	5-20	0	0	0
1403:								
Overly	0-17	27-35	20-40	6.6-7.8	0	0	0	0
	17-56	18-34	15-30	6.6-8.4	0-10	0-2	0.0-2.0	0
	56-60	18-35	15-30	7.9-8.4	10-20	0-2	0.0-4.0	0-2
1427:								
Parnell	0-17	27-40	30-50	6.1-7.8	0	0	0	0
	17-60	35-45	20-40	6.6-8.4	0-3	0-2	0	0
1466:								
Pits, gravel and sand	0-6	5-15	2-12	6.6-8.4	0-3	0	0	0
	6-60	0-15	1-10	6.6-8.4	5-20	0	0	0
1472:								
Rauville	0-40	15-26	15-35	7.4-8.4	5-15	0	0.0-2.0	1-2
	40-60	20-45	20-35	7.4-8.4	10-20	0-1	0.0-4.0	1-3
1523:								
Renshaw	0-7	10-19	20-25	6.1-7.8	0	—	0.0-2.0	0
	7-15	18-27	1-10	6.6-8.4	0-1	—	0.0-2.0	0
	15-60	0-5	1-10	6.6-8.4	1-15	—	0.0-2.0	0
1560:								
Rifle	0-9	—	140-180	5.6-7.3	0	0	0	0
	9-60	—	140-180	5.6-7.3	0	0	0	0
1577:								
Rosewood	0-14	8-18	10-20	7.4-8.4	5-10	—	0	0
	14-19	6-18	1-10	7.4-8.4	10-35	—	0	0
	19-60	1-6	0-5	7.4-8.4	10-25	—	0	0-2
1648:								
Serden	0-5	3-8	3-5	6.1-7.3	0	0	0	0
	5-60	3-8	2-3	6.6-7.8	0-3	0	0	0
Duneland	0-6	0-5	—	6.1-7.3	—	—	0	—
	6-60	0-5	—	6.6-7.8	—	—	0	—

Table 21.--Chemical Properties of the Soils--(continued)

(Dashes (--) indicate that data were not available or were not estimated.)

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
1670:								
Ulen	0-14	8-20	10-50	7.4-8.4	10-15	--	0.0-4.0	0
	14-30	5-12	1-10	7.9-8.4	15-35	--	0.0-4.0	0
	30-60	1-7	0-5	7.4-8.4	10-20	--	0.0-4.0	0-2
Rosewood	0-14	8-18	10-20	7.4-8.4	5-10	--	0	0
	14-19	6-18	1-10	7.4-8.4	10-35	--	0	0
	19-60	1-6	0-5	7.4-8.4	10-25	--	0	0-2
1704:								
Sioux	0-7	10-18	15-20	6.6-8.4	0	0	0.0-2.0	0
	7-60	0-10	15-20	7.4-8.4	0-15	0	0.0-2.0	0
Renshaw	0-7	10-19	20-25	6.1-7.8	0	--	0.0-2.0	0
	7-15	18-27	1-10	6.6-8.4	0-1	--	0.0-2.0	0
	15-60	0-5	1-10	6.6-8.4	1-15	--	0.0-2.0	0
1709:								
Southam	0-8	15-26	20-50	6.6-8.4	0-10	0-1	2.0-8.0	0-2
	8-33	35-50	25-60	6.6-8.4	3-25	0-1	2.0-8.0	0-2
	33-60	18-50	10-45	7.4-8.4	10-30	0-5	2.0-8.0	0-2
1772:								
Svea	0-12	18-27	15-30	6.1-7.8	0	0	0	0
	12-33	18-35	10-30	6.6-7.8	0-3	0	0	0
	33-60	18-35	10-25	7.4-8.4	3-15	0-1	0.0-4.0	0-2
Gardena	0-14	12-18	10-25	6.6-7.8	0-3	0	0	0
	14-60	10-18	5-15	7.4-8.4	0-15	0-2	0.0-2.0	0-2
1788:								
Swenoda	0-8	10-20	10-25	6.1-7.3	0	0	0.0-2.0	0
	8-29	10-18	5-15	6.6-7.8	0	0	0.0-2.0	0
	29-60	20-35	2-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
Barnes	0-7	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	7-15	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	15-28	18-35	5-25	--	0-3	0	0.0-4.0	0
	28-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
1834:								
Tonka	0-19	18-27	20-40	5.6-7.8	0	0	0	0
	19-34	35-45	25-40	5.6-7.8	0-1	0-1	0.0-2.0	0-1
	34-60	18-39	10-35	6.6-8.4	5-20	0-2	0.0-4.0	0-2
1842:								
Towner	0-20	2-10	3-10	6.6-7.8	0	0	0	0
	20-29	2-10	1-10	6.6-7.8	0	0	0	0
	29-60	18-40	5-25	7.4-8.4	10-30	0-2	0.0-2.0	0
1859:								
Ulen	0-14	8-20	10-50	7.4-8.4	10-15	--	0.0-4.0	0
	14-30	5-12	1-10	7.9-8.4	15-35	--	0.0-4.0	0
	30-60	1-7	0-5	7.4-8.4	10-20	--	0.0-4.0	0-2
1871:								
Vallers, saline	0-12	18-27	15-30	7.4-8.4	5-10	0-1	4.0-16.0	0-3
	12-38	18-35	10-25	7.4-8.4	15-35	0-3	4.0-16.0	0-5
	38-60	18-35	10-20	7.4-8.4	15-30	0-3	4.0-16.0	0-10

Table 21.--Chemical Properties of the Soils--(continued)

(Dashes (--) indicate that data were not available or were not estimated.)

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
1883:								
Vallers	0-12	18-27	20-40	7.4-8.4	5-10	0-1	0.0-4.0	0
	12-38	18-35	10-30	7.4-8.4	15-30	0-2	0.0-4.0	0-5
	38-60	18-35	10-20	7.4-8.4	15-30	0-2	0.0-4.0	0-10
Parnell	0-17	27-40	25-45	6.1-7.8	0	0	0	0
	17-60	35-45	15-30	6.6-8.4	0-3	0-2	0	0
1935:								
Venlo	0-13	5-10	5-15	6.1-7.3	0	0	0	0
	13-60	0-7	1-5	6.6-8.4	1-15	0	0	0
1953:								
Wahpeton	0-19	40-59	30-60	6.1-7.8	5-10	--	0	0
	19-60	35-59	20-40	6.6-8.4	5-15	--	0	0-2
1978:								
Water	--	--	--	--	--	--	--	--
2049:								
Wyndmere	0-9	5-15	10-25	7.4-8.4	10-20	0-1	0	0-1
	9-27	3-15	3-20	7.4-8.4	15-35	0-1	0.0-2.0	0-1
	27-60	3-15	1-10	7.4-8.4	5-20	0-1	0.0-2.0	0-3
2091:								
Zell	0-7	10-18	10-20	6.6-8.4	0-5	0	0.0-2.0	0
	7-29	10-18	5-15	7.4-8.4	10-20	0	0.0-2.0	0
	29-60	5-18	2-10	7.4-8.4	5-15	0	0.0-2.0	0
2206:								
Barnes	0-7	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	7-15	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	15-28	18-35	5-25	--	0-3	0	0.0-4.0	0
	28-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0
Sioux	0-7	10-18	15-20	6.6-8.4	0	0	0.0-2.0	0
	7-60	0-10	15-20	7.4-8.4	0-15	0	0.0-2.0	0
2207:								
Bearden	0-9	18-26	25-40	7.4-8.4	0-10	0-1	0.0-4.0	0-2
	9-43	18-34	15-25	7.4-8.4	10-45	0-1	0.0-4.0	0-3
	43-60	2-10	5-15	7.4-8.4	5-20	0-5	0.0-8.0	0-10
2208:								
Brantford	0-9	10-19	10-25	6.1-7.8	0	0	0	0
	9-16	18-27	10-20	6.6-7.8	0-1	0	0	0
	16-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Coe	0-7	6-18	5-15	6.6-7.8	0-5	0	0	0
	7-60	2-8	1-5	7.4-8.4	5-20	0	0	0
2209:								
Buse	0-6	18-27	10-30	6.6-8.4	1-10	0	0	0
	6-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
Barnes	0-7	15-27	10-30	5.6-7.8	0	0	0.0-2.0	0
	7-15	18-35	10-30	6.1-7.8	0-3	0	0.0-4.0	0
	15-28	18-35	5-25	--	0-3	0	0.0-4.0	0
	28-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0

Table 21.--Chemical Properties of the Soils--(continued)

(Dashes (--) indicate that data were not available or were not estimated.)

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
2210:								
Cathay	0-14	10-27	15-30	6.1-7.8	0	---	0.0-2.0	0
	14-21	18-35	10-20	6.6-8.4	0	---	4.0-8.0	1-10
	21-60	7-18	5-15	7.4-9.0	5-20	---	4.0-8.0	5-15
Larson	0-10	10-27	---	6.1-7.3	0	0	0.0-2.0	0
	10-22	18-35	---	7.4-9.0	1-10	0-2	4.0-16.0	5-17
	22-60	10-35	---	7.9-9.0	10-35	0-4	2.0-8.0	5-10
2211:								
Eckman	0-6	12-18	10-20	6.6-7.8	0	0	0	0
	6-37	10-18	5-20	6.6-8.4	0-15	0	0	0
	37-60	10-18	5-20	7.4-8.4	0-15	0	0	0
Gardena	0-14	12-18	10-25	6.6-7.8	0	0	0	0
	14-60	10-18	5-15	7.4-8.4	0-15	0-2	0.0-2.0	0-2
2212:								
Eckman	0-6	12-18	10-20	6.6-7.8	0	0	0	0
	6-37	10-18	5-20	6.6-8.4	0-15	0	0	0
	37-60	10-18	5-20	7.4-8.4	0-15	0	0	0
Zell	0-7	10-18	10-20	6.6-8.4	0-5	0	0.0-2.0	0
	7-29	10-18	5-15	7.4-8.4	10-20	0	0.0-2.0	0
	29-60	5-18	2-10	7.4-8.4	5-15	0	0.0-2.0	0
2213:								
Eckman	0-6	12-18	10-20	6.6-7.8	0	0	0	0
	6-37	10-18	5-20	6.6-8.4	0-15	0	0	0
	37-60	10-18	5-20	7.4-8.4	0-15	0	0	0
Zell	0-7	10-18	10-20	6.6-8.4	0-5	0	0.0-2.0	0
	7-29	10-18	5-15	7.4-8.4	10-20	0	0.0-2.0	0
	29-60	5-18	2-10	7.4-8.4	5-15	0	0.0-2.0	0
2214:								
Exline	0-1	20-26	11-20	6.1-7.8	0	0	0.0-2.0	0
	1-12	35-55	18-27	6.6-9.0	0-15	0-2	4.0-16.0	5-20
	12-35	35-50	17-26	7.9-9.0	3-20	0-10	4.0-8.0	5-20
	35-60	25-35	12-18	7.9-9.0	3-20	0-5	2.0-8.0	5-15
2215:								
Fairdale	0-13	18-27	15-30	7.4-7.8	3-10	0	0	0
	13-60	18-35	10-20	7.4-8.4	5-35	0	0.0-2.0	0
2216:								
Gwinner	0-11	27-39	20-40	6.1-7.8	0	0	0	0
	11-21	35-50	15-30	6.6-7.8	0-5	0	0	0
	21-27	18-35	10-20	7.4-8.4	10-25	0	0.0-4.0	0-2
	27-60	18-35	10-20	7.4-8.4	10-20	0	0.0-4.0	0-2
Peever	0-8	27-35	25-30	6.1-7.3	0	0	0.0-2.0	0
	8-20	35-50	25-30	6.6-7.8	0-10	0-5	0.0-2.0	0-5
	20-43	30-45	20-25	7.4-8.4	10-20	0-10	0.0-4.0	0-10
	43-60	30-45	15-25	7.4-8.4	10-15	0-10	0.0-8.0	0-10
Parnell	0-17	27-40	25-45	6.1-7.8	0	0	0	0
	17-60	35-45	15-30	6.6-8.4	0-3	0-2	0	0

Table 21.--Chemical Properties of the Soils--(continued)

(Dashes (--) indicate that data were not available or were not estimated.)

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
2217:								
Hamerly----------------	0-8	18-27	15-30	6.6-8.4	1-10	0	0.0-2.0	0
	8-22	18-35	10-20	7.4-8.4	10-30	0-2	0.0-4.0	0-2
	22-60	18-35	10-20	7.4-8.4	5-25	0-2	0.0-4.0	0-2
Buse-------------------	0-6	18-27	10-30	6.6-8.4	1-10	0	0	0
	6-60	18-35	5-25	7.4-8.4	10-30	0-1	0.0-4.0	0-2
Parnell----------------	0-17	27-40	30-50	6.1-7.8	0	0	0	0
	17-60	35-45	20-40	6.6-8.4	0-3	0-2	0	0
2218:								
Brantford--------------	0-8	10-19	10-25	6.1-7.8	0	0	0	0
	8-15	18-27	10-20	6.6-7.8	0-1	0	0	0
	15-60	2-8	1-5	7.4-8.4	5-20	0	0	0
Vang-------------------	0-9	18-27	15-25	5.6-7.3	0	0-1	0	0-1
	9-27	18-30	10-20	5.6-8.4	1-5	0-1	0	0-1
	27-60	0-5	5-10	5.6-8.4	5-15	0-1	0	0-2
2219:								
Hegne------------------	0-7	27-39	25-45	7.4-8.4	10-20	0-1	0	0
	7-24	40-60	25-55	7.4-8.4	15-30	0-1	0.0-4.0	0-2
	24-60	40-60	25-50	7.4-8.4	10-20	0-3	0.0-4.0	0-2
2220:								
Letcher----------------	0-8	5-10	10-15	5.1-7.8	0	0	0.0-2.0	0
	8-17	10-18	10-16	5.1-7.8	0-7	0	0.0-2.0	1-7
	17-24	10-15	7-14	6.6-9.0	10-20	1-3	2.0-8.0	5-17
	24-60	10-15	7-14	7.4-9.0	5-15	1-3	2.0-8.0	5-15
Lemert-----------------	0-5	10-18	5-20	6.6-9.0	0	---	4.0-8.0	0-5
	5-12	10-18	5-15	8.5-9.0	0-5	---	8.0-16.0	10-20
	12-27	10-18	0-5	8.5-9.0	5-10	---	4.0-8.0	10-20
	27-60	0-35	0-20	7.4-8.4	10-20	---	2.0-8.0	5-20
2221:								
Falsen-----------------	0-12	5-15	4-15	6.6-7.8	0	0	0	0
	12-25	5-15	1-10	6.6-7.8	0	0	0	0
	25-60	0-10	0-7	7.4-8.4	1-5	0	0	0
2222:								
Peever-----------------	0-8	27-35	25-30	6.1-7.3	0	0	0.0-2.0	0
	8-20	35-50	25-30	6.6-7.8	0-10	0-5	0.0-2.0	0-5
	20-43	30-45	20-25	7.4-8.4	10-20	0-10	0.0-4.0	0-10
	43-60	30-45	15-25	7.4-8.4	10-15	0-10	0.0-8.0	0-10
Gwinner----------------	0-11	27-39	20-40	6.1-7.8	0	0	0	0
	11-21	35-50	15-30	6.6-7.8	0-5	0	0	0
	21-27	18-35	10-20	7.4-8.4	10-25	0	0.0-4.0	0-2
	27-60	18-35	10-20	7.4-8.4	10-20	0	0.0-4.0	0-2
2223:								
Renshaw----------------	0-7	10-19	20-25	6.1-7.8	0	---	0.0-2.0	0
	7-15	18-27	1-10	6.6-8.4	0-5	---	0.0-2.0	0
	15-60	0-5	1-10	6.6-8.4	1-15	---	0.0-2.0	0
Sioux------------------	0-7	10-18	15-20	6.6-8.4	0	0	0.0-2.0	0
	7-60	0-10	15-20	7.4-8.4	0-15	0	0.0-2.0	0

Table 21.--Chemical Properties of the Soils--(continued)

(Dashes (--) indicate that data were not available or were not estimated.)

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	Pct	meq/100 g	pH	Pct	Pct	mmhos/cm	
2224:								
Serden	0-5	3-8	3-5	6.1-7.3	0	0	0	0
	5-60	3-8	2-3	6.6-7.8	0-3	0	0	0
Hamar	0-15	5-10	7-12	6.1-7.8	0	0	0.0-2.0	0
	15-23	0-7	3-9	6.6-8.4	0-1	0	0.0-2.0	0
	23-60	0-7	3-9	7.4-8.4	0-2	0	0.0-2.0	0
2225:								
Sioux	0-5	2-18	15-20	6.6-8.4	0	0	0.0-2.0	0
	5-60	0-10	5-10	7.4-8.4	0-15	0	0.0-2.0	0
2226:								
Stirum	0-3	10-20	10-20	7.4-8.4	1-10	0	2.0-8.0	0-2
	3-21	10-25	5-15	7.9-9.0	10-45	0-2	2.0-16.0	10-20
	21-60	5-20	5-10	7.9-9.0	10-45	0-4	2.0-16.0	5-15
Lemert	0-5	10-18	5-20	6.6-9.0	0	--	4.0-8.0	0-5
	5-12	10-18	5-15	8.5-9.0	0-5	--	8.0-16.0	10-20
	12-27	10-18	0-5	8.5-9.0	5-10	--	4.0-8.0	10-20
	27-60	0-35	0-20	7.4-8.4	10-20	--	2.0-8.0	5-20
2228:								
Aylmer	0-7	3-8	5-10	6.6-7.3	0	--	0	0
	7-60	3-8	1-5	6.1-8.4	0-5	--	0	0
Rosewood	0-14	8-18	10-20	7.4-8.4	5-10	--	0	0
	14-19	6-18	1-10	7.4-8.4	10-35	--	0	0
	19-60	1-6	0-5	7.4-8.4	10-25	--	0	0-2
Serden	0-5	3-8	3-5	6.1-7.3	0	0	0	0
	5-60	3-8	2-3	6.6-7.8	0-3	0	0	0

Table 22.—Water Features

(Dashes (—) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydro-logic group	Month	Water Table Upper limit	Water Table Lower limit	Ponding Surface water depth	Ponding Duration	Ponding Frequency	Flooding Duration	Flooding Frequency
64:									
Arveson	B/D								
		January	1.5-3.5	> 6.0	—	—	—	—	—
		February	1.5-3.5	> 6.0	—	—	—	—	—
		March	0.0-1.5	> 6.0	—	—	—	—	—
		April	0.0-1.5	> 6.0	—	—	—	—	—
		May	0.0-1.5	> 6.0	—	—	—	—	—
		June	0.0-1.5	> 6.0	—	—	—	—	—
		July	0.0-1.5	> 6.0	—	—	—	—	—
		August	1.5-3.5	> 6.0	—	—	—	—	—
		September	1.5-3.5	> 6.0	—	—	—	—	—
		October	1.5-3.5	> 6.0	—	—	—	—	—
		November	1.5-3.5	> 6.0	—	—	—	—	—
		December	1.5-3.5	> 6.0	—	—	—	—	—
76:									
Arvilla	B								
		All months	—	—	—	—	—	—	—
86:									
Aylmer	A								
		January	4.0-6.0	> 6.0	—	—	—	—	—
		February	4.0-6.0	> 6.0	—	—	—	—	—
		March	4.0-6.0	> 6.0	—	—	—	—	—
		April	3.0-5.0	> 6.0	—	—	—	—	—
		May	3.0-5.0	> 6.0	—	—	—	—	—
		June	3.0-5.0	> 6.0	—	—	—	—	—
		July	4.0-6.0	> 6.0	—	—	—	—	—
		August	4.0-6.0	> 6.0	—	—	—	—	—
		September	4.0-6.0	> 6.0	—	—	—	—	—
		October	4.0-6.0	> 6.0	—	—	—	—	—
		November	4.0-6.0	> 6.0	—	—	—	—	—
		December	4.0-6.0	> 6.0	—	—	—	—	—
Bantry	A/D								
		January	3.0-5.0	> 6.0	—	—	—	—	—
		February	3.0-5.0	> 6.0	—	—	—	—	—
		March	3.0-5.0	> 6.0	—	—	—	—	—
		April	1.5-3.5	> 6.0	—	—	—	—	—
		May	1.5-3.5	> 6.0	—	—	—	—	—
		June	1.5-3.5	> 6.0	—	—	—	—	—
		July	3.0-5.0	> 6.0	—	—	—	—	—
		August	3.0-5.0	> 6.0	—	—	—	—	—
		September	3.0-5.0	> 6.0	—	—	—	—	—
		October	3.0-5.0	> 6.0	—	—	—	—	—
		November	3.0-5.0	> 6.0	—	—	—	—	—
		December	3.0-5.0	> 6.0	—	—	—	—	—
118:									
Barnes	B								
		April	4.0-6.0	> 6.0	—	—	—	—	—
		May	4.0-6.0	> 6.0	—	—	—	—	—
		June	4.0-6.0	> 6.0	—	—	—	—	—
Buse	B								
		April	4.0-6.0	> 6.0	—	—	—	—	—
		May	4.0-6.0	> 6.0	—	—	—	—	—
		June	4.0-6.0	> 6.0	—	—	—	—	—

Table 22.—Water Features--(continued)

(Dashes (—) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydro-logic group	Month	Water Table: Upper limit	Water Table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
120:									
Barnes	B								
		All months	—	—	—	—	—	—	—
Buse	B								
		All months	—	—	—	—	—	—	—
154:									
Barnes	B								
		April	4.0-6.0	> 6.0	—	—	—	—	—
		May	4.0-6.0	> 6.0	—	—	—	—	—
		June	4.0-6.0	> 6.0	—	—	—	—	—
Svea	B								
		January	4.0-6.0	> 6.0	—	—	—	—	—
		February	4.0-6.0	> 6.0	—	—	—	—	—
		March	4.0-6.0	> 6.0	—	—	—	—	—
		April	3.0-5.0	> 6.0	—	—	—	—	—
		May	3.0-5.0	> 6.0	—	—	—	—	—
		June	3.0-5.0	> 6.0	—	—	—	—	—
		July	4.0-6.0	> 6.0	—	—	—	—	—
		August	4.0-6.0	> 6.0	—	—	—	—	—
		September	4.0-6.0	> 6.0	—	—	—	—	—
		October	4.0-6.0	> 6.0	—	—	—	—	—
		November	4.0-6.0	> 6.0	—	—	—	—	—
		December	4.0-6.0	> 6.0	—	—	—	—	—
156:									
Barnes	B								
		April	4.0-6.0	> 6.0	—	—	—	—	—
		May	4.0-6.0	> 6.0	—	—	—	—	—
		June	4.0-6.0	> 6.0	—	—	—	—	—
Svea	B								
		January	4.0-6.0	> 6.0	—	—	—	—	—
		February	4.0-6.0	> 6.0	—	—	—	—	—
		March	4.0-6.0	> 6.0	—	—	—	—	—
		April	3.0-5.0	> 6.0	—	—	—	—	—
		May	3.0-5.0	> 6.0	—	—	—	—	—
		June	3.0-5.0	> 6.0	—	—	—	—	—
		July	4.0-6.0	> 6.0	—	—	—	—	—
		August	4.0-6.0	> 6.0	—	—	—	—	—
		September	4.0-6.0	> 6.0	—	—	—	—	—
		October	4.0-6.0	> 6.0	—	—	—	—	—
		November	4.0-6.0	> 6.0	—	—	—	—	—
		December	4.0-6.0	> 6.0	—	—	—	—	—
314:									
Buse	B								
		All months	—	—	—	—	—	—	—
Barnes	B								
		All months	—	—	—	—	—	—	—

Table 22.--Water Features--(continued)

(Dashes (--) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydrologic group	Month	Water Table: Upper limit	Water Table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
450:									
Colvin	C/D								
		January	1.5-3.5	> 6.0	--	--	--	--	--
		February	1.5-3.5	> 6.0	--	--	--	--	--
		March	0.0-1.5	> 6.0	--	--	--	--	--
		April	0.0-1.5	> 6.0	--	--	--	--	--
		May	0.0-1.5	> 6.0	--	--	--	--	--
		June	0.0-1.5	> 6.0	--	--	--	--	--
		July	0.0-1.5	> 6.0	--	--	--	--	--
		August	1.5-3.5	> 6.0	--	--	--	--	--
		September	1.5-3.5	> 6.0	--	--	--	--	--
		October	1.5-3.5	> 6.0	--	--	--	--	--
		November	1.5-3.5	> 6.0	--	--	--	--	--
		December	1.5-3.5	> 6.0	--	--	--	--	--
493:									
Darnen	B								
		April	4.0-6.0	> 6.0	--	--	--	--	--
		May	4.0-6.0	> 6.0	--	--	--	--	--
		June	4.0-6.0	> 6.0	--	--	--	--	--
510:									
Divide	B								
		January	3.0-5.0	> 6.0	--	--	--	--	--
		February	3.0-5.0	> 6.0	--	--	--	--	--
		March	3.0-5.0	> 6.0	--	--	--	--	--
		April	1.5-3.5	> 6.0	--	--	--	--	--
		May	1.5-3.5	> 6.0	--	--	--	--	--
		June	1.5-3.5	> 6.0	--	--	--	--	--
		July	3.0-5.0	> 6.0	--	--	--	--	--
		August	3.0-5.0	> 6.0	--	--	--	--	--
		September	3.0-5.0	> 6.0	--	--	--	--	--
		October	3.0-5.0	> 6.0	--	--	--	--	--
		November	3.0-5.0	> 6.0	--	--	--	--	--
		December	3.0-5.0	> 6.0	--	--	--	--	--
571:									
Embden	B								
		January	4.0-6.0	> 6.0	--	--	--	--	--
		February	4.0-6.0	> 6.0	--	--	--	--	--
		March	4.0-6.0	> 6.0	--	--	--	--	--
		April	3.0-5.0	> 6.0	--	--	--	--	--
		May	3.0-5.0	> 6.0	--	--	--	--	--
		June	3.0-5.0	> 6.0	--	--	--	--	--
		July	4.0-6.0	> 6.0	--	--	--	--	--
		August	4.0-6.0	> 6.0	--	--	--	--	--
		September	4.0-6.0	> 6.0	--	--	--	--	--
		October	4.0-6.0	> 6.0	--	--	--	--	--
		November	4.0-6.0	> 6.0	--	--	--	--	--
		December	4.0-6.0	> 6.0	--	--	--	--	--
726:									
Fordville	B								
		April	4.0-6.0	> 6.0	--	--	--	--	--
		May	4.0-6.0	> 6.0	--	--	--	--	--
		June	4.0-6.0	> 6.0	--	--	--	--	--

Table 22.—Water Features--(continued)

(Dashes (—) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydro-logic group	Month	Water Table: Upper limit	Water Table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
772:									
Gardena	B								
		January	4.0-6.0	> 6.0	—	—	—	—	—
		February	4.0-6.0	> 6.0	—	—	—	—	—
		March	4.0-6.0	> 6.0	—	—	—	—	—
		April	3.0-5.0	> 6.0	—	—	—	—	—
		May	3.0-5.0	> 6.0	—	—	—	—	—
		June	3.0-5.0	> 6.0	—	—	—	—	—
		July	4.0-6.0	> 6.0	—	—	—	—	—
		August	4.0-6.0	> 6.0	—	—	—	—	—
		September	4.0-6.0	> 6.0	—	—	—	—	—
		October	4.0-6.0	> 6.0	—	—	—	—	—
		November	4.0-6.0	> 6.0	—	—	—	—	—
		December	4.0-6.0	> 6.0	—	—	—	—	—
Eckman	B								
		April	4.0-6.0	> 6.0	—	—	—	—	—
		May	4.0-6.0	> 6.0	—	—	—	—	—
		June	4.0-6.0	> 6.0	—	—	—	—	—
794:									
Glyndon	B								
		January	3.0-5.0	> 6.0	—	—	—	—	—
		February	3.0-5.0	> 6.0	—	—	—	—	—
		March	3.0-5.0	> 6.0	—	—	—	—	—
		April	1.5-3.5	> 6.0	—	—	—	—	—
		May	1.5-3.5	> 6.0	—	—	—	—	—
		June	1.5-3.5	> 6.0	—	—	—	—	—
		July	3.0-5.0	> 6.0	—	—	—	—	—
		August	3.0-5.0	> 6.0	—	—	—	—	—
		September	3.0-5.0	> 6.0	—	—	—	—	—
		October	3.0-5.0	> 6.0	—	—	—	—	—
		November	3.0-5.0	> 6.0	—	—	—	—	—
		December	3.0-5.0	> 6.0	—	—	—	—	—
795:									
Glyndon, saline	B								
		January	3.0-5.0	> 6.0	—	—	—	—	—
		February	3.0-5.0	> 6.0	—	—	—	—	—
		March	3.0-5.0	> 6.0	—	—	—	—	—
		April	1.5-3.5	> 6.0	—	—	—	—	—
		May	1.5-3.5	> 6.0	—	—	—	—	—
		June	1.5-3.5	> 6.0	—	—	—	—	—
		July	3.0-5.0	> 6.0	—	—	—	—	—
		August	3.0-5.0	> 6.0	—	—	—	—	—
		September	3.0-5.0	> 6.0	—	—	—	—	—
		October	3.0-5.0	> 6.0	—	—	—	—	—
		November	3.0-5.0	> 6.0	—	—	—	—	—
		December	3.0-5.0	> 6.0	—	—	—	—	—

Table 22.—Water Features--(continued)

(Dashes (—) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydrologic group	Month	Water Table: Upper limit	Water Table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
852:									
Hamar	A/D								
		January	1.5-3.5	> 6.0	—	—	—	—	—
		February	1.5-3.5	> 6.0	—	—	—	—	—
		March	0.0-1.5	> 6.0	0.0-0.5	Long	Frequent	—	—
		April	0.0-1.5	> 6.0	0.0-0.5	Long	Frequent	—	—
		May	0.0-1.5	> 6.0	0.0-0.5	Long	Frequent	—	—
		June	0.0-1.5	> 6.0	0.0-0.5	Brief	Occasional	—	—
		July	0.0-1.5	> 6.0	0.0-0.5	Brief	Rare	—	—
		August	1.5-3.5	> 6.0	—	—	—	—	—
		September	1.5-3.5	> 6.0	—	—	—	—	—
		October	1.5-3.5	> 6.0	—	—	—	—	—
		November	1.5-3.5	> 6.0	—	—	—	—	—
		December	1.5-3.5	> 6.0	—	—	—	—	—
883:									
Hamerly	C								
		January	3.0-5.0	> 6.0	—	—	—	—	—
		February	3.0-5.0	> 6.0	—	—	—	—	—
		March	3.0-5.0	> 6.0	—	—	—	—	—
		April	1.5-3.5	> 6.0	—	—	—	—	—
		May	1.5-3.5	> 6.0	—	—	—	—	—
		June	1.5-3.5	> 6.0	—	—	—	—	—
		July	3.0-5.0	> 6.0	—	—	—	—	—
		August	3.0-5.0	> 6.0	—	—	—	—	—
		September	3.0-5.0	> 6.0	—	—	—	—	—
		October	3.0-5.0	> 6.0	—	—	—	—	—
		November	3.0-5.0	> 6.0	—	—	—	—	—
		December	3.0-5.0	> 6.0	—	—	—	—	—
Tonka	C/D								
		January	1.5-3.5	> 6.0	—	—	—	—	—
		February	1.5-3.5	> 6.0	—	—	—	—	—
		March[1]	1.5-2.0	> 6.0	0.0-1.0	Long	Frequent	—	—
			0.0	1.0-1.5					
		April[1]	0.0	1.0-1.5	0.0-1.0	Long	Frequent	—	—
			1.5-2.0	> 6.0					
		May	0.0-1.5	> 6.0	0.0-1.0	Long	Frequent	—	—
		June	0.0-1.5	> 6.0	0.0-1.0	Long	Frequent	—	—
		July	0.0-1.5	> 6.0	—	—	—	—	—
		August	3.0-5.0	> 6.0	—	—	—	—	—
		September	1.5-3.5	> 6.0	—	—	—	—	—
		October	1.5-3.5	> 6.0	—	—	—	—	—
		November	1.5-3.5	> 6.0	—	—	—	—	—
		December	1.5-3.5	> 6.0	—	—	—	—	—
Parnell	C/D								
		January	0.0	> 6.0	0.0-2.0	Long	Occasional	—	—
		February	0.0	> 6.0	0.0-2.0	Long	Occasional	—	—
		March	0.0	> 6.0	0.0-2.0	Long	Frequent	—	—
		April	0.0	> 6.0	0.0-2.0	Very long	Frequent	—	—
		May	0.0	> 6.0	0.0-2.0	Very long	Frequent	—	—
		June	0.0	> 6.0	0.0-2.0	Very long	Frequent	—	—
		July	0.0	> 6.0	0.0-2.0	Long	Occasional	—	—
		August	0.0-1.5	> 6.0	0.0-2.0	Brief	Occasional	—	—
		September	0.0-1.5	> 6.0	0.0-2.0	Brief	Occasional	—	—
		October	0.0-1.5	> 6.0	0.0-2.0	Long	Occasional	—	—
		November	0.0	> 6.0	0.0-2.0	Long	Occasional	—	—
		December	0.0	> 6.0	0.0-2.0	Long	Occasional	—	—

Table 22.--Water Features--(continued)

(Dashes (—) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydro-logic group	Month	Water Table: Upper limit	Water Table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
939:									
Hecla	A								
		January	4.0-6.0	> 6.0	—	—	—	—	—
		February	4.0-6.0	> 6.0	—	—	—	—	—
		March	4.0-6.0	> 6.0	—	—	—	—	—
		April	3.0-5.0	> 6.0	—	—	—	—	—
		May	3.0-5.0	> 6.0	—	—	—	—	—
		June	3.0-5.0	> 6.0	—	—	—	—	—
		July	4.0-6.0	> 6.0	—	—	—	—	—
		August	4.0-6.0	> 6.0	—	—	—	—	—
		September	4.0-6.0	> 6.0	—	—	—	—	—
		October	4.0-6.0	> 6.0	—	—	—	—	—
		November	4.0-6.0	> 6.0	—	—	—	—	—
		December	4.0-6.0	> 6.0	—	—	—	—	—
Hamar	A/D								
		January	3.0-5.0	> 6.0	—	—	—	—	—
		February	3.0-5.0	> 6.0	—	—	—	—	—
		March	3.0-5.0	> 6.0	—	—	—	—	—
		April	1.5-3.5	> 6.0	—	—	—	—	—
		May	1.5-3.5	> 6.0	—	—	—	—	—
		June	1.5-3.5	> 6.0	—	—	—	—	—
		July	3.0-5.0	> 6.0	—	—	—	—	—
		August	3.0-5.0	> 6.0	—	—	—	—	—
		September	3.0-5.0	> 6.0	—	—	—	—	—
		October	3.0-5.0	> 6.0	—	—	—	—	—
		November	3.0-5.0	> 6.0	—	—	—	—	—
		December	3.0-5.0	> 6.0	—	—	—	—	—
1030:									
Kranzburg	B								
		April	4.0-6.0	> 6.0	—	—	—	—	—
		May	4.0-6.0	> 6.0	—	—	—	—	—
		June	4.0-6.0	> 6.0	—	—	—	—	—
Lismore	B								
		January	4.0-6.0	> 6.0	—	—	—	—	—
		February	4.0-6.0	> 6.0	—	—	—	—	—
		March	4.0-6.0	> 6.0	—	—	—	—	—
		April	3.0-5.0	> 6.0	—	—	—	—	—
		May	3.0-5.0	> 6.0	—	—	—	—	—
		June	3.0-5.0	> 6.0	—	—	—	—	—
		July	4.0-6.0	> 6.0	—	—	—	—	—
		August	4.0-6.0	> 6.0	—	—	—	—	—
		September	4.0-6.0	> 6.0	—	—	—	—	—
		October	4.0-6.0	> 6.0	—	—	—	—	—
		November	4.0-6.0	> 6.0	—	—	—	—	—
		December	4.0-6.0	> 6.0	—	—	—	—	—
1043:									
La Prairie	B								
		January	4.0-6.0	> 6.0	—	—	—	—	—
		February	4.0-6.0	> 6.0	—	—	—	—	—
		March	4.0-6.0	> 6.0	—	—	—	—	—
		April	3.0-5.0	> 6.0	—	—	—	Brief	Rare
		May	3.0-5.0	> 6.0	—	—	—	Brief	Rare
		June	3.0-5.0	> 6.0	—	—	—	Brief	Rare

Table 22.--Water Features--(continued)

(Dashes (--) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydro-logic group	Month	Water Table: Upper limit	Water Table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
1043: (con't)									
La Prairie		July	4.0-6.0	> 6.0	—	—	—	—	—
		August	4.0-6.0	> 6.0	—	—	—	—	—
		September	4.0-6.0	> 6.0	—	—	—	—	—
		October	4.0-6.0	> 6.0	—	—	—	—	—
		November	4.0-6.0	> 6.0	—	—	—	—	—
		December	4.0-6.0	> 6.0	—	—	—	—	—
1055:									
LaDelle	B								
		January	4.0-6.0	> 6.0	—	—	—	—	—
		February	4.0-6.0	> 6.0	—	—	—	—	—
		March	4.0-6.0	> 6.0	—	—	—	—	—
		April	3.0-5.0	> 6.0	—	—	—	Brief	Rare
		May	3.0-5.0	> 6.0	—	—	—	Brief	Rare
		June	3.0-5.0	> 6.0	—	—	—	Brief	Rare
		July	4.0-6.0	> 6.0	—	—	—	—	—
		August	4.0-6.0	> 6.0	—	—	—	—	—
		September	4.0-6.0	> 6.0	—	—	—	—	—
		October	4.0-6.0	> 6.0	—	—	—	—	—
		November	4.0-6.0	> 6.0	—	—	—	—	—
		December	4.0-6.0	> 6.0	—	—	—	—	—
1081:									
Lamoure	C								
		January	1.5-3.5	> 6.0	—	—	—	—	—
		February	1.5-3.5	> 6.0	—	—	—	—	—
		March	0.5-1.5	> 6.0	—	—	—	Brief	Rare
		April	0.5-1.5	> 6.0	—	—	—	Brief	Rare
		May	0.5-1.5	> 6.0	—	—	—	Brief	Rare
		June	0.5-1.5	> 6.0	—	—	—	Brief	Rare
		July	0.5-1.5	> 6.0	—	—	—	Brief	Rare
		August	1.5-3.5	> 6.0	—	—	—	—	—
		September	1.5-3.5	> 6.0	—	—	—	—	—
		October	1.5-3.5	> 6.0	—	—	—	—	—
		November	1.5-3.5	> 6.0	—	—	—	—	—
		December	1.5-3.5	> 6.0	—	—	—	—	—
1168:									
Lismore	B								
		January	4.0-6.0	> 6.0	—	—	—	—	—
		February	4.0-6.0	> 6.0	—	—	—	—	—
		March	4.0-6.0	> 6.0	—	—	—	—	—
		April	3.0-5.0	> 6.0	—	—	—	—	—
		May	3.0-5.0	> 6.0	—	—	—	—	—
		June	3.0-5.0	> 6.0	—	—	—	—	—
		July	4.0-6.0	> 6.0	—	—	—	—	—
		August	4.0-6.0	> 6.0	—	—	—	—	—
		September	4.0-6.0	> 6.0	—	—	—	—	—
		October	4.0-6.0	> 6.0	—	—	—	—	—
		November	4.0-6.0	> 6.0	—	—	—	—	—
		December	4.0-6.0	> 6.0	—	—	—	—	—
Kranzburg	B								
		April	4.0-6.0	> 6.0	—	—	—	—	—
		May	4.0-6.0	> 6.0	—	—	—	—	—
		June	4.0-6.0	> 6.0	—	—	—	—	—

Table 22.--Water Features--(continued)

(Dashes (--) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydro-logic group	Month	Water Table: Upper limit	Water Table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
1205:									
Maddock	A								
		All months	--	--	--	--	--	--	--
1221:									
Maddock	A								
		All months	--	--	--	--	--	--	--
Hecla	A								
		January	4.0-6.0	> 6.0	--	--	--	--	--
		February	4.0-6.0	> 6.0	--	--	--	--	--
		March	4.0-6.0	> 6.0	--	--	--	--	--
		April	3.0-5.0	> 6.0	--	--	--	--	--
		May	3.0-5.0	> 6.0	--	--	--	--	--
		June	3.0-5.0	> 6.0	--	--	--	--	--
		July	4.0-6.0	> 6.0	--	--	--	--	--
		August	4.0-6.0	> 6.0	--	--	--	--	--
		September	4.0-6.0	> 6.0	--	--	--	--	--
		October	4.0-6.0	> 6.0	--	--	--	--	--
		November	4.0-6.0	> 6.0	--	--	--	--	--
		December	4.0-6.0	> 6.0	--	--	--	--	--
1269:									
Marysland	B/D								
		January	1.5-3.5	> 6.0	--	--	--	--	--
		February	1.5-3.5	> 6.0	--	--	--	--	--
		March	0.0-1.5	> 6.0	--	--	--	--	--
		April	0.0-1.5	> 6.0	--	--	--	--	--
		May	0.0-1.5	> 6.0	--	--	--	--	--
		June	0.0-1.5	> 6.0	--	--	--	--	--
		July	0.0-1.5	> 6.0	--	--	--	--	--
		August	1.5-3.5	> 6.0	--	--	--	--	--
		September	1.5-3.5	> 6.0	--	--	--	--	--
		October	1.5-3.5	> 6.0	--	--	--	--	--
		November	1.5-3.5	> 6.0	--	--	--	--	--
		December	1.5-3.5	> 6.0	--	--	--	--	--
1403:									
Overly	C								
		January	4.0-6.0	> 6.0	--	--	--	--	--
		February	4.0-6.0	> 6.0	--	--	--	--	--
		March	4.0-6.0	> 6.0	--	--	--	--	--
		April	3.0-5.0	> 6.0	--	--	--	--	--
		May	3.0-5.0	> 6.0	--	--	--	--	--
		June	3.0-5.0	> 6.0	--	--	--	--	--
		July	4.0-6.0	> 6.0	--	--	--	--	--
		August	4.0-6.0	> 6.0	--	--	--	--	--
		September	4.0-6.0	> 6.0	--	--	--	--	--
		October	4.0-6.0	> 6.0	--	--	--	--	--
		November	4.0-6.0	> 6.0	--	--	--	--	--
		December	4.0-6.0	> 6.0	--	--	--	--	--

Table 22.--Water Features--(continued)

(Dashes (--) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydrologic group	Month	Water Table: Upper limit	Water Table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
1427:									
Parnell	C/D								
		January	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
		February	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
		March	0.0	> 6.0	0.0-2.0	Long	Frequent	--	--
		April	0.0	> 6.0	0.0-2.0	Very long	Frequent	--	--
		May	0.0	> 6.0	0.0-2.0	Very long	Frequent	--	--
		June	0.0	> 6.0	0.0-2.0	Very long	Frequent	--	--
		July	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
		August	0.0-1.5	> 6.0	0.0-2.0	Brief	Occasional	--	--
		September	0.0-1.5	> 6.0	0.0-2.0	Brief	Occasional	--	--
		October	0.0-1.5	> 6.0	0.0-2.0	Long	Occasional	--	--
		November	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
		December	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
1466:									
Pits, gravel and sand	A								
		All months	--	--	--	--	--	--	--
1472:									
Rauville	D								
		January	0.0-1.0	> 6.0	--	--	--	--	--
		February	0.0-1.0	> 6.0	--	--	--	--	--
		March	0.0-1.0	> 6.0	--	--	--	Long	Frequent
		April	0.0-0.5	> 6.0	--	--	--	Long	Frequent
		May	0.0-0.5	> 6.0	--	--	--	Long	Frequent
		June	0.0-0.5	> 6.0	--	--	--	Brief	Occasional
		July	0.0-0.5	> 6.0	--	--	--	Brief	Occasional
		August	0.0-1.0	> 6.0	--	--	--	Very brief	Rare
		September	0.0-1.0	> 6.0	--	--	--	Very brief	Rare
		October	0.0-1.0	> 6.0	--	--	--	Brief	Rare
		November	0.0-1.0	> 6.0	--	--	--	--	--
		December	0.0-1.0	> 6.0	--	--	--	--	--
1523:									
Renshaw	B								
		All months	--	--	--	--	--	--	--
1560:									
Rifle	A/D								
		January	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
		February	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
		March	0.0	> 6.0	0.0-2.0	Very long	Frequent	--	--
		April	0.0	> 6.0	0.0-2.0	Very long	Frequent	--	--
		May	0.0	> 6.0	0.0-2.0	Very long	Frequent	--	--
		June	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
		July	0.0	> 6.0	--	--	--	--	--
		August	0.0	> 6.0	--	--	--	--	--
		September	0.0	> 6.0	--	--	--	--	--
		October	0.0	> 6.0	--	--	--	--	--
		November	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
		December	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
1577:									
Rosewood	A/D								
		January	1.5-3.5	> 6.0	--	--	--	--	--
		February	1.5-3.5	> 6.0	--	--	--	--	--
		March	0.0-1.5	> 6.0	--	--	--	--	--
		April	0.0-1.5	> 6.0	--	--	--	--	--
		May	0.0-1.5	> 6.0	--	--	--	--	--

Table 22.--Water Features--(continued)

(Dashes (--) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydro-logic group	Month	Water Table: Upper limit	Water Table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
1577: (con't)									
Rosewood		June	0.0-1.5	> 6.0	--	--	--	--	--
		July	0.0-1.5	> 6.0	--	--	--	--	--
		August	1.5-3.5	> 6.0	--	--	--	--	--
		September	1.5-3.5	> 6.0	--	--	--	--	--
		October	1.5-3.5	> 6.0	--	--	--	--	--
		November	1.5-3.5	> 6.0	--	--	--	--	--
		December	1.5-3.5	> 6.0	--	--	--	--	--
1648:									
Serden	A								
		All months	--	--	--	--	--	--	--
Duneland	A								
		All months	--	--	--	--	--	--	--
1670:									
Ulen	B								
		January	3.0-5.0	> 6.0	--	--	--	--	--
		February	3.0-5.0	> 6.0	--	--	--	--	--
		March	3.0-5.0	> 6.0	--	--	--	--	--
		April	1.5-3.5	> 6.0	--	--	--	--	--
		May	1.5-3.5	> 6.0	--	--	--	--	--
		June	1.5-3.5	> 6.0	--	--	--	--	--
		July	3.0-5.0	> 6.0	--	--	--	--	--
		August	3.0-5.0	> 6.0	--	--	--	--	--
		September	3.0-5.0	> 6.0	--	--	--	--	--
		October	3.0-5.0	> 6.0	--	--	--	--	--
		November	3.0-5.0	> 6.0	--	--	--	--	--
		December	3.0-5.0	> 6.0	--	--	--	--	--
Rosewood	A/D								
		January	1.5-3.5	> 6.0	--	--	--	--	--
		February	1.5-3.5	> 6.0	--	--	--	--	--
		March	0.0-1.5	> 6.0	--	--	--	--	--
		April	0.0-1.5	> 6.0	--	--	--	--	--
		May	0.0-1.5	> 6.0	--	--	--	--	--
		June	0.0-1.5	> 6.0	--	--	--	--	--
		July	0.0-1.5	> 6.0	--	--	--	--	--
		August	1.5-3.5	> 6.0	--	--	--	--	--
		September	1.5-3.5	> 6.0	--	--	--	--	--
		October	1.5-3.5	> 6.0	--	--	--	--	--
		November	1.5-3.5	> 6.0	--	--	--	--	--
		December	1.5-3.5	> 6.0	--	--	--	--	--
1704:									
Sioux	A								
		All months	--	--	--	--	--	--	--
Renshaw	B								
		All months	--	--	--	--	--	--	--
1709:									
Southam	D								
		January	0.0	> 6.0	0.0-5.0	Very long	Frequent	--	--
		February	0.0	> 6.0	0.0-5.0	Very long	Frequent	--	--
		March	0.0	> 6.0	0.0-5.0	Very long	Frequent	--	--

Table 22.—Water Features--(continued)

(Dashes (—) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydro-logic group	Month	Water Table: Upper limit	Water Table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
1709: (con't)									
Southam		April	0.0	> 6.0	0.0-5.0	Very long	Frequent	—	—
		May	0.0	> 6.0	0.0-5.0	Very long	Frequent	—	—
		June	0.0	> 6.0	0.0-5.0	Very long	Frequent	—	
		July	0.0	> 6.0	0.0-5.0	Very long	Frequent	—	—
		August	0.0-1.0	> 6.0	0.0-5.0	Long	Frequent	—	—
		September	0.0-1.0	> 6.0	0.0-5.0	Long	Frequent	—	—
		October	0.0-1.0	> 6.0	0.0-5.0	Long	Frequent	—	—
		November	0.0	> 6.0	0.0-5.0	Very long	Frequent	—	—
		December	0.0	> 6.0	0.0-5.0	Very long	Frequent	—	—
1772:									
Svea	B								
		January	4.0-6.0	> 6.0	—	—	—	—	—
		February	4.0-6.0	> 6.0	—	—	—	—	—
		March	4.0-6.0	> 6.0	—	—	—	—	—
		April	3.0-5.0	> 6.0	—	—	—	—	—
		May	3.0-5.0	> 6.0	—	—	—	—	—
		June	3.0-5.0	> 6.0	—	—	—	—	—
		July	4.0-6.0	> 6.0	—	—	—	—	—
		August	4.0-6.0	> 6.0	—	—	—	—	—
		September	4.0-6.0	> 6.0	—	—	—	—	—
		October	4.0-6.0	> 6.0	—	—	—	—	—
		November	4.0-6.0	> 6.0	—	—	—	—	—
		December	4.0-6.0	> 6.0	—	—	—	—	—
Gardena	B								
		January	4.0-6.0	> 6.0	—	—	—	—	—
		February	4.0-6.0	> 6.0	—	—	—	—	—
		March	4.0-6.0	> 6.0	—	—	—	—	—
		April	3.0-5.0	> 6.0	—	—	—	—	—
		May	3.0-5.0	> 6.0	—	—	—	—	—
		June	3.0-5.0	> 6.0	—	—	—	—	—
		July	4.0-6.0	> 6.0	—	—	—	—	—
		August	4.0-6.0	> 6.0	—	—	—	—	—
		September	4.0-6.0	> 6.0	—	—	—	—	—
		October	4.0-6.0	> 6.0	—	—	—	—	—
		November	4.0-6.0	> 6.0	—	—	—	—	—
		December	4.0-6.0	> 6.0	—	—	—	—	—
1788:									
Swenoda	B								
		January	4.0-6.0	> 6.0	—	—	—	—	—
		February	4.0-6.0	> 6.0	—	—	—	—	—
		March	4.0-6.0	> 6.0	—	—	—	—	—
		April	3.0-5.0	> 6.0	—	—	—	—	—
		May	3.0-5.0	> 6.0	—	—	—	—	—
		June	3.0-5.0	> 6.0	—	—	—	—	—
		July	4.0-6.0	> 6.0	—	—	—	—	—
		August	4.0-6.0	> 6.0	—	—	—	—	—
		September	4.0-6.0	> 6.0	—	—	—	—	—
		October	4.0-6.0	> 6.0	—	—	—	—	—
		November	4.0-6.0	> 6.0	—	—	—	—	—
		December	4.0-6.0	> 6.0	—	—	—	—	—
Barnes	B								
		April	4.0-6.0	> 6.0	—	—	—	—	—
		May	4.0-6.0	> 6.0	—	—	—	—	—
		June	4.0-6.0	> 6.0	—	—	—	—	—

Table 22.--Water Features--(continued)

(Dashes (--) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydro-logic group	Month	Water Table: Upper limit	Water Table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
1834:									
Tonka	C/D								
		January	1.5-3.5	> 6.0	--	--	--	--	--
		February	1.5-3.5	> 6.0	--	--	--	--	--
		March[1]	1.5-2.0	> 6.0	0.0-1.0	Long	Frequent	--	--
			0.0	1.0-1.5					
		April[1]	0.0	1.0-1.5	0.0-1.0	Long	Frequent	--	--
			1.5-2.0	> 6.0					
		May	0.0-1.5	> 6.0	0.0-1.0	Long	Frequent	--	--
		June	0.0-1.5	> 6.0	0.0-1.0	Long	Frequent	--	--
		July	0.0-1.5	> 6.0	--	--	--	--	--
		August	3.0-5.0	> 6.0	--	--	--	--	--
		September	1.5-3.5	> 6.0	--	--	--	--	--
		October	1.5-3.5	> 6.0	--	--	--	--	--
		November	1.5-3.5	> 6.0	--	--	--	--	--
		December	1.5-3.5	> 6.0	--	--	--	--	--
1842:									
Towner	B								
		January	4.0-6.0	> 6.0	--	--	--	--	--
		February	4.0-6.0	> 6.0	--	--	--	--	--
		March	4.0-6.0	> 6.0	--	--	--	--	--
		April	3.0-5.0	> 6.0	--	--	--	--	--
		May	3.0-5.0	> 6.0	--	--	--	--	--
		June	3.0-5.0	> 6.0	--	--	--	--	--
		July	4.0-6.0	> 6.0	--	--	--	--	--
		August	4.0-6.0	> 6.0	--	--	--	--	--
		September	4.0-6.0	> 6.0	--	--	--	--	--
		October	4.0-6.0	> 6.0	--	--	--	--	--
		November	4.0-6.0	> 6.0	--	--	--	--	--
		December	4.0-6.0	> 6.0	--	--	--	--	--
1859:									
Ulen	B								
		January	3.0-5.0	> 6.0	--	--	--	--	--
		February	3.0-5.0	> 6.0	--	--	--	--	--
		March	3.0-5.0	> 6.0	--	--	--	--	--
		April	1.5-3.5	> 6.0	--	--	--	--	--
		May	1.5-3.5	> 6.0	--	--	--	--	--
		June	1.5-3.5	> 6.0	--	--	--	--	--
		July	3.0-5.0	> 6.0	--	--	--	--	--
		August	3.0-5.0	> 6.0	--	--	--	--	--
		September	3.0-5.0	> 6.0	--	--	--	--	--
		October	3.0-5.0	> 6.0	--	--	--	--	--
		November	3.0-5.0	> 6.0	--	--	--	--	--
		December	3.0-5.0	> 6.0	--	--	--	--	--
1871:									
Vallers, saline	C								
		January	1.5-3.5	> 6.0	--	--	--	--	--
		February	1.5-3.5	> 6.0	--	--	--	--	--
		March	0.0-1.5	> 6.0	--	--	--	--	--
		April	0.0-1.5	> 6.0	--	--	--	--	--
		May	0.0-1.5	> 6.0	--	--	--	--	--
		June	0.0-1.5	> 6.0	--	--	--	--	--
		July	0.0-1.5	> 6.0	--	--	--	--	--
		August	1.5-3.5	> 6.0	--	--	--	--	--
		September	1.5-3.5	> 6.0	--	--	--	--	--
		October	1.5-3.5	> 6.0	--	--	--	--	--
		November	1.5-3.5	> 6.0	--	--	--	--	--
		December	1.5-3.5	> 6.0	--	--	--	--	--

Table 22.-Water Features--(continued)

(Dashes (—) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydro-logic group	Month	Water Table: Upper limit	Water Table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
1883:									
Vallers	C								
		January	1.5-3.5	> 6.0	—	—	—	—	—
		February	1.5-3.5	> 6.0	—	—	—	—	—
		March	0.0-1.5	> 6.0	—	—	—	—	—
		April	0.0-1.5	> 6.0	—	—	—	—	—
		May	0.0-1.5	> 6.0	—	—	—	—	—
		June	0.0-1.5	> 6.0	—	—	—	—	—
		July	0.0-1.5	> 6.0	—	—	—	—	—
		August	1.5-3.5	> 6.0	—	—	—	—	—
		September	1.5-3.5	> 6.0	—	—	—	—	—
		October	1.5-3.5	> 6.0	—	—	—	—	—
		November	1.5-3.5	> 6.0	—	—	—	—	—
		December	1.5-3.5	> 6.0	—	—	—	—	—
Parnell	C/D								
		January	0.0	> 6.0	0.0-2.0	Long	Occasional	—	—
		February	0.0	> 6.0	0.0-2.0	Long	Occasional	—	—
		March	0.0	> 6.0	0.0-2.0	Long	Frequent	—	—
		April	0.0	> 6.0	0.0-2.0	Very long	Frequent	—	—
		May	0.0	> 6.0	0.0-2.0	Very long	Frequent	—	—
		June	0.0	> 6.0	0.0-2.0	Very long	Frequent	—	—
		July	0.0	> 6.0	0.0-2.0	Long	Occasional	—	—
		August	0.0-1.5	> 6.0	0.0-2.0	Brief	Occasional	—	—
		September	0.0-1.5	> 6.0	0.0-2.0	Brief	Occasional	—	—
		October	0.0-1.5	> 6.0	0.0-2.0	Long	Occasional	—	—
		November	0.0	> 6.0	0.0-2.0	Long	Occasional	—	—
		December	0.0	> 6.0	0.0-2.0	Long	Occasional	—	—
1935:									
Venlo	A/D								
		January	0.0-1.5	> 6.0	—	—	—	—	—
		February	0.0-1.5	> 6.0	—	—	—	—	—
		March	0.0-1.0	> 6.0	0.0-0.5	Long	Frequent	—	—
		April	0.0-1.0	> 6.0	0.0-0.5	Long	Frequent	—	—
		May	0.0-1.0	> 6.0	0.0-0.5	Long	Frequent	—	—
		June	0.0-1.0	> 6.0	0.0-0.5	Brief	Occasional	—	—
		July	0.0-1.0	> 6.0	0.0-0.5	Brief	Occasional	—	—
		August	0.0-1.5	> 6.0	—	—	—	—	—
		September	0.0-1.5	> 6.0	—	—	—	—	—
		October	0.0-1.5	> 6.0	—	—	—	—	—
		November	0.0-1.5	> 6.0	—	—	—	—	—
		December	0.0-1.5	> 6.0	—	—	—	—	—
1953:									
Wahpeton	C								
		January	4.0-6.0	> 6.0	—	—	—	—	—
		February	4.0-6.0	> 6.0	—	—	—	—	—
		March	4.0-6.0	> 6.0	—	—	—	Brief	Occasional
		April	3.0-5.0	> 6.0	—	—	—	Brief	Occasional
		May	3.0-5.0	> 6.0	—	—	—	Brief	Occasional
		June	3.0-5.0	> 6.0	—	—	—	Brief	Occasional
		July	4.0-6.0	> 6.0	—	—	—	—	—
		November	4.0-6.0	> 6.0	—	—	—	—	—
		December	4.0-6.0	> 6.0	—	—	—	—	—

Table 22.--Water Features--(continued)

(Dashes (--) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydro-logic group	Month	Water Table: Upper limit	Water Table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
1978:									
Water	--								
		January	0.0	> 6.0	5.0->6.0	Very long	Frequent	--	--
		February	0.0	> 6.0	5.0->6.0	Very long	Frequent	--	--
		March	0.0	> 6.0	5.0->6.0	Very long	Frequent	--	--
		April	0.0	> 6.0	5.0->6.0	Very long	Frequent	--	--
		May	0.0	> 6.0	5.0->6.0	Very long	Frequent	--	--
		June	0.0	> 6.0	5.0->6.0	Very long	Frequent	--	--
		July	0.0	> 6.0	5.0->6.0	Very long	Frequent	--	--
		August	0.0	> 6.0	5.0->6.0	Very long	Frequent	--	--
		September	0.0	> 6.0	5.0->6.0	Very long	Frequent	--	--
		October	0.0	> 6.0	5.0->6.0	Very long	Frequent	--	--
		November	0.0	> 6.0	5.0->6.0	Very long	Frequent	--	--
		December	0.0	> 6.0	5.0->6.0	Very long	Frequent	--	--
2049:									
Wyndmere	B								
		January	3.0-5.0	> 6.0	--	--	--	--	--
		February	3.0-5.0	> 6.0	--	--	--	--	--
		March	3.0-5.0	> 6.0	--	--	--	--	--
		April	1.5-3.5	> 6.0	--	--	--	--	--
		May	1.5-3.5	> 6.0	--	--	--	--	--
		June	1.5-3.5	> 6.0	--	--	--	--	--
		July	3.0-5.0	> 6.0	--	--	--	--	--
		August	3.0-5.0	> 6.0	--	--	--	--	--
		September	3.0-5.0	> 6.0	--	--	--	--	--
		October	3.0-5.0	> 6.0	--	--	--	--	--
		November	3.0-5.0	> 6.0	--	--	--	--	--
		December	3.0-5.0	> 6.0	--	--	--	--	--
2091:									
Zell	B								
		All months	--	--	--	--	--	--	--
2206:									
Barnes	B								
		All months	--	--	--	--	--	--	--
Sioux	A								
		All months	--	--	--	--	--	--	--
2207:									
Bearden	C								
		January	3.0-5.0	> 6.0	--	--	--	--	--
		February	3.0-5.0	> 6.0	--	--	--	--	--
		March	3.0-5.0	> 6.0	--	--	--	--	--
		April	1.5-3.5	> 6.0	--	--	--	--	--
		May	1.5-3.5	> 6.0	--	--	--	--	--
		June	1.5-3.5	> 6.0	--	--	--	--	--
		July	3.0-5.0	> 6.0	--	--	--	--	--
		August	3.0-5.0	> 6.0	--	--	--	--	--
		September	3.0-5.0	> 6.0	--	--	--	--	--
		October	3.0-5.0	> 6.0	--	--	--	--	--
		November	3.0-5.0	> 6.0	--	--	--	--	--
		December	3.0-5.0	> 6.0	--	--	--	--	--

Table 22.--Water Features--(continued)

(Dashes (--) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydrologic group	Month	Water Table: Upper limit	Water Table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
2208:									
Brantford	B								
		April	4.0-6.0	> 6.0	--	--	--	--	--
		May	4.0-6.0	> 6.0	--	--	--	--	--
		June	4.0-6.0	> 6.0	--	--	--	--	--
Coe	A								
		All months	--	--	--	--	--	--	--
2209:									
Buse	B								
		All months	--	--	--	--	--	--	--
Barnes	B								
		All months	--	--	--	--	--	--	--
2210:									
Cathay	C								
		January	4.0-6.0	> 6.0	--	--	--	--	--
		February	4.0-6.0	> 6.0	--	--	--	--	--
		March	4.0-6.0	> 6.0	--	--	--	--	--
		April	3.0-5.0	> 6.0	--	--	--	--	--
		May	3.0-5.0	> 6.0	--	--	--	--	--
		June	3.0-5.0	> 6.0	--	--	--	--	--
		July	4.0-6.0	> 6.0	--	--	--	--	--
		August	4.0-6.0	> 6.0	--	--	--	--	--
		September	4.0-6.0	> 6.0	--	--	--	--	--
		October	4.0-6.0	> 6.0	--	--	--	--	--
		November	4.0-6.0	> 6.0	--	--	--	--	--
		December	4.0-6.0	> 6.0	--	--	--	--	--
Larson	D								
		January	4.0-6.0	> 6.0	--	--	--	--	--
		February	4.0-6.0	> 6.0	--	--	--	--	--
		March	4.0-6.0	> 6.0	--	--	--	--	--
		April	3.0-6.0	> 6.0	--	--	--	--	--
		May	3.0-6.0	> 6.0	--	--	--	--	--
		June	3.0-6.0	> 6.0	--	--	--	--	--
		July	4.0-6.0	> 6.0	--	--	--	--	--
		August	4.0-6.0	> 6.0	--	--	--	--	--
		September	4.0-6.0	> 6.0	--	--	--	--	--
		October	4.0-6.0	> 6.0	--	--	--	--	--
		November	4.0-6.0	> 6.0	--	--	--	--	--
		December	4.0-6.0	> 6.0	--	--	--	--	--
2211:									
Eckman	B								
		April	4.0-6.0	> 6.0	--	--	--	--	--
		May	4.0-6.0	> 6.0	--	--	--	--	--
		June	4.0-6.0	> 6.0	--	--	--	--	--
Gardena	B								
		January	4.0-6.0	> 6.0	--	--	--	--	--
		February	4.0-6.0	> 6.0	--	--	--	--	--
		March	4.0-6.0	> 6.0	--	--	--	--	--
		April	3.0-5.0	> 6.0	--	--	--	--	--
		May	3.0-5.0	> 6.0	--	--	--	--	--
		June	3.0-5.0	> 6.0	--	--	--	--	--

Table 22.--Water Features--(continued)

(Dashes (--) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydro-logic group	Month	Water Table: Upper limit	Water Table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
2211: (con't)									
Gardena		July	4.0-6.0	> 6.0	--	--	--	--	--
		August	4.0-6.0	> 6.0	--	--	--	--	--
		September	4.0-6.0	> 6.0	--	--	--	--	--
		October	4.0-6.0	> 6.0	--	--	--	--	--
		November	4.0-6.0	> 6.0	--	--	--	--	--
		December	4.0-6.0	> 6.0	--	--	--	--	--
2212:									
Eckman	B								
		April	4.0-6.0	> 6.0	--	--	--	--	--
		May	4.0-6.0	> 6.0	--	--	--	--	--
		June	4.0-6.0	> 6.0	--	--	--	--	--
Zell	B								
		April	4.0-6.0	> 6.0	--	--	--	--	--
		May	4.0-6.0	> 6.0	--	--	--	--	--
		June	4.0-6.0	> 6.0	--	--	--	--	--
2213:									
Eckman	B								
		All months	--	--	--	--	--	--	--
Zell	B								
		All months	--	--	--	--	--	--	--
2214:									
Exline	D								
		January	3.0-5.0	> 6.0	--	--	--	--	--
		February	3.0-5.0	> 6.0	--	--	--	--	--
		March	3.0-5.0	> 6.0	--	--	--	--	--
		April	1.5-3.5	> 6.0	--	--	--	--	--
		May	1.5-3.5	> 6.0	--	--	--	--	--
		June	1.5-3.5	> 6.0	--	--	--	--	--
		July	3.0-5.0	> 6.0	--	--	--	--	--
		August	3.0-5.0	> 6.0	--	--	--	--	--
		September	3.0-5.0	> 6.0	--	--	--	--	--
		October	3.0-5.0	> 6.0	--	--	--	--	--
		November	3.0-5.0	> 6.0	--	--	--	--	--
		December	3.0-5.0	> 6.0	--	--	--	--	--
2215:									
Fairdale	B								
		January	4.0-6.0	> 6.0	--	--	--	--	--
		February	4.0-6.0	> 6.0	--	--	--	--	--
		March	4.0-6.0	> 6.0	--	--	--	--	--
		April	3.0-5.0	> 6.0	--	--	--	--	--
		May	3.0-5.0	> 6.0	--	--	--	--	--
		June	3.0-5.0	> 6.0	--	--	--	--	--
		July	4.0-6.0	> 6.0	--	--	--	--	--
		August	4.0-6.0	> 6.0	--	--	--	--	--
		September	4.0-6.0	> 6.0	--	--	--	--	--
		October	4.0-6.0	> 6.0	--	--	--	--	--
		November	4.0-6.0	> 6.0	--	--	--	--	--
		December	4.0-6.0	> 6.0	--	--	--	--	--

Table 22.--Water Features--(continued)

(Dashes (--) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydro-logic group	Month	Water Table Upper limit	Water Table Lower limit	Ponding Surface water depth	Ponding Duration	Ponding Frequency	Flooding Duration	Flooding Frequency
2216:									
Gwinner	C								
		January	4.0-6.0	> 6.0	--	--	--	--	--
		February	4.0-6.0	> 6.0	--	--	--	--	--
		March	4.0-6.0	> 6.0	--	--	--	--	--
		April	3.0-5.0	> 6.0	--	--	--	--	--
		May	3.0-5.0	> 6.0	--	--	--	--	--
		June	3.0-5.0	> 6.0	--	--	--	--	--
		July	4.0-6.0	> 6.0	--	--	--	--	--
		August	4.0-6.0	> 6.0	--	--	--	--	--
		September	4.0-6.0	> 6.0	--	--	--	--	--
		October	4.0-6.0	> 6.0	--	--	--	--	--
		November	4.0-6.0	> 6.0	--	--	--	--	--
		December	4.0-6.0	> 6.0	--	--	--	--	--
Peever	C								
		April	4.0-6.0	> 6.0	--	--	--	--	--
		May	4.0-6.0	> 6.0	--	--	--	--	--
		June	4.0-6.0	> 6.0	--	--	--	--	--
Parnell	C/D								
		January	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
		February	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
		March	0.0	> 6.0	0.0-2.0	Long	Frequent	--	--
		April	0.0	> 6.0	0.0-2.0	Very long	Frequent	--	--
		May	0.0	> 6.0	0.0-2.0	Very long	Frequent	--	--
		June	0.0	> 6.0	0.0-2.0	Very long	Frequent	--	--
		July	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
		August	0.0-1.5	> 6.0	0.0-2.0	Brief	Occasional	--	--
		September	0.0-1.5	> 6.0	0.0-2.0	Brief	Occasional	--	--
		October	0.0-1.5	> 6.0	0.0-2.0	Long	Occasional	--	--
		November	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
		December	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
2217:									
Hamerly	C								
		January	3.0-5.0	> 6.0	--	--	--	--	--
		February	3.0-5.0	> 6.0	--	--	--	--	--
		March	3.0-5.0	> 6.0	--	--	--	--	--
		April	1.5-3.5	> 6.0	--	--	--	--	--
		May	1.5-3.5	> 6.0	--	--	--	--	--
		June	1.5-3.5	> 6.0	--	--	--	--	--
		July	3.0-5.0	> 6.0	--	--	--	--	--
		August	3.0-5.0	> 6.0	--	--	--	--	--
		September	3.0-5.0	> 6.0	--	--	--	--	--
		October	3.0-5.0	> 6.0	--	--	--	--	--
		November	3.0-5.0	> 6.0	--	--	--	--	--
		December	3.0-5.0	> 6.0	--	--	--	--	--
Buse	B								
		April	4.0-6.0	> 6.0	--	--	--	--	--
		May	4.0-6.0	> 6.0	--	--	--	--	--
		June	4.0-6.0	> 6.0	--	--	--	--	--

Table 22.--Water Features--(continued)

(Dashes (--) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydro-logic group	Month	Water Table: Upper limit	Water Table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
2217: (con't)									
Parnell	C/D								
		January	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
		February	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
		March	0.0	> 6.0	0.0-2.0	Long	Frequent	--	--
		April	0.0	> 6.0	0.0-2.0	Very long	Frequent	--	--
		May	0.0	> 6.0	0.0-2.0	Very long	Frequent	--	--
		June	0.0	> 6.0	0.0-2.0	Very long	Frequent	--	--
		July	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
		August	0.0-1.5	> 6.0	0.0-2.0	Brief	Occasional	--	--
		September	0.0-1.5	> 6.0	0.0-2.0	Brief	Occasional	--	--
		October	0.0-1.5	> 6.0	0.0-2.0	Long	Occasional	--	--
		November	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
		December	0.0	> 6.0	0.0-2.0	Long	Occasional	--	--
2218:									
Brantford	B								
		April	4.0-6.0	> 6.0	--	--	--	--	--
		May	4.0-6.0	> 6.0	--	--	--	--	--
		June	4.0-6.0	> 6.0	--	--	--	--	--
Vang	B								
		April	3.0-5.0	> 6.0	--	--	--	--	--
		May	3.0-5.0	> 6.0	--	--	--	--	--
		June	3.0-5.0	> 6.0	--	--	--	--	--
2219:									
Hegne	D								
		January	1.5-3.5	> 6.0	--	--	--	--	--
		February	1.5-3.5	> 6.0	--	--	--	--	--
		March	0.0-1.5	> 6.0	--	--	--	--	--
		April	0.0-1.5	> 6.0	--	--	--	--	--
		May	0.0-1.5	> 6.0	--	--	--	--	--
		June	0.0-1.5	> 6.0	--	--	--	--	--
		July	0.0-1.5	> 6.0	--	--	--	--	--
		August	1.5-3.5	> 6.0	--	--	--	--	--
		September	1.5-3.5	> 6.0	--	--	--	--	--
		October	1.5-3.5	> 6.0	--	--	--	--	--
		November	1.5-3.5	> 6.0	--	--	--	--	--
		December	1.5-3.5	> 6.0	--	--	--	--	--
2220:									
Letcher	D								
		January	4.0-6.0	> 6.0	--	--	--	--	--
		February	4.0-6.0	> 6.0	--	--	--	--	--
		March	4.0-6.0	> 6.0	--	--	--	--	--
		April	3.0-5.0	> 6.0	--	--	--	--	--
		May	3.0-5.0	> 6.0	--	--	--	--	--
		June	3.0-5.0	> 6.0	--	--	--	--	--
		July	4.0-6.0	> 6.0	--	--	--	--	--
		August	4.0-6.0	> 6.0	--	--	--	--	--
		September	4.0-6.0	> 6.0	--	--	--	--	--
		October	4.0-6.0	> 6.0	--	--	--	--	--
		November	4.0-6.0	> 6.0	--	--	--	--	--
		December	4.0-6.0	> 6.0	--	--	--	--	--

Table 22.—Water Features--(continued)

(Dashes (—) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydrologic group	Month	Water Table: Upper limit	Water Table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
2220: (con't)									
Lemert	D								
		January	3.0-5.0	> 6.0	—	—	—	—	—
		February	3.0-5.0	> 6.0	—	—	—	—	—
		March	3.0-5.0	> 6.0	—	—	—	—	—
		April	1.5-3.5	> 6.0	—	—	—	—	—
		May	1.5-3.5	> 6.0	—	—	—	—	—
		June	1.5-3.5	> 6.0	—	—	—	—	—
		July	3.0-5.0	> 6.0	—	—	—	—	—
		August	3.0-5.0	> 6.0	—	—	—	—	—
		September	3.0-5.0	> 6.0	—	—	—	—	—
		October	3.0-5.0	> 6.0	—	—	—	—	—
		November	3.0-5.0	> 6.0	—	—	—	—	—
		December	3.0-5.0	> 6.0	—	—	—	—	—
2221:									
Falsen	A								
		January	4.0-6.0	> 6.0	—	—	—	—	—
		February	4.0-6.0	> 6.0	—	—	—	—	—
		March	4.0-6.0	> 6.0	—	—	—	—	—
		April	3.0-5.0	> 6.0	—	—	—	—	—
		May	3.0-5.0	> 6.0	—	—	—	—	—
		June	3.0-5.0	> 6.0	—	—	—	—	—
		July	4.0-6.0	> 6.0	—	—	—	—	—
		August	4.0-6.0	> 6.0	—	—	—	—	—
		September	4.0-6.0	> 6.0	—	—	—	—	—
		October	4.0-6.0	> 6.0	—	—	—	—	—
		November	4.0-6.0	> 6.0	—	—	—	—	—
		December	4.0-6.0	> 6.0	—	—	—	—	—
2222:									
Peever	C								
		April	4.0-6.0	> 6.0	—	—	—	—	—
		May	4.0-6.0	> 6.0	—	—	—	—	—
		June	4.0-6.0	> 6.0	—	—	—	—	—
Gwinner	C								
		January	4.0-6.0	> 6.0	—	—	—	—	—
		February	4.0-6.0	> 6.0	—	—	—	—	—
		March	4.0-6.0	> 6.0	—	—	—	—	—
		April	3.0-5.0	> 6.0	—	—	—	—	—
		May	3.0-5.0	> 6.0	—	—	—	—	—
		June	3.0-5.0	> 6.0	—	—	—	—	—
		July	4.0-6.0	> 6.0	—	—	—	—	—
		August	4.0-6.0	> 6.0	—	—	—	—	—
		September	4.0-6.0	> 6.0	—	—	—	—	—
		October	4.0-6.0	> 6.0	—	—	—	—	—
		November	4.0-6.0	> 6.0	—	—	—	—	—
		December	4.0-6.0	> 6.0	—	—	—	—	—
2223:									
Renshaw	B								
		All months	—	—	—	—	—	—	—
Sioux	A								
		All months	—	—	—	—	—	—	—

Table 22.--Water Features--(continued)

(Dashes (--) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydro-logic group	Month	Water Table: Upper limit	Water Table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
2224:									
Serden	A								
		All months	--	--	--	--	--	--	--
Hamar	A/D								
		January	1.5-3.5	> 6.0	--	--	--	--	--
		February	1.5-3.5	> 6.0	--	--	--	--	--
		March	0.0-1.5	> 6.0	0.0-0.5	Long	Frequent	--	--
		April	0.0-1.5	> 6.0	0.0-0.5	Long	Frequent	--	--
		May	0.0-1.5	> 6.0	0.0-0.5	Long	Frequent	--	--
		June	0.0-1.5	> 6.0	0.0-0.5	Brief	Occasional	--	--
		July	0.0-1.5	> 6.0	0.0-0.5	Brief	Rare	--	--
		August	1.5-3.5	> 6.0	--	--	--	--	--
		September	1.5-3.5	> 6.0	--	--	--	--	--
		October	1.5-3.5	> 6.0	--	--	--	--	--
		November	1.5-3.5	> 6.0	--	--	--	--	--
		December	1.5-3.5	> 6.0	--	--	--	--	--
2225:									
Sioux	A								
		All months	--	--	--	--	--	--	--
2226:									
Stirum	B/D								
		January	1.5-3.5	> 6.0	--	--	--	--	--
		February	1.5-3.5	> 6.0	--	--	--	--	--
		March	0.0-1.5	> 6.0	0.0-0.5	Long	Occasional	--	--
		April	0.0-1.5	> 6.0	0.0-0.5	Long	Occasional	--	--
		May	0.0-1.5	> 6.0	0.0-0.5	Long	Occasional	--	--
		June	0.0-1.5	> 6.0	0.0-0.5	Brief	Rare	--	--
		July	0.0-1.5	> 6.0	0.0-0.5	Very brief	Rare	--	--
		August	1.5-3.5	> 6.0	--	--	--	--	--
		September	1.5-3.5	> 6.0	--	--	--	--	--
		October	1.5-3.5	> 6.0	--	--	--	--	--
		November	1.5-3.5	> 6.0	--	--	--	--	--
		December	1.5-3.5	> 6.0	--	--	--	--	--
Lemert	D								
		January	3.0-5.0	> 6.0	--	--	--	--	--
		February	3.0-5.0	> 6.0	--	--	--	--	--
		March	3.0-5.0	> 6.0	--	--	--	--	--
		April	1.5-3.5	> 6.0	--	--	--	--	--
		May	1.5-3.5	> 6.0	--	--	--	--	--
		June	1.5-3.5	> 6.0	--	--	--	--	--
		July	3.0-5.0	> 6.0	--	--	--	--	--
		August	3.0-5.0	> 6.0	--	--	--	--	--
		September	3.0-5.0	> 6.0	--	--	--	--	--
		October	3.0-5.0	> 6.0	--	--	--	--	--
		November	3.0-5.0	> 6.0	--	--	--	--	--
		December	3.0-5.0	> 6.0	--	--	--	--	--
2228:									
Aylmer	A								
		January	4.0-6.0	> 6.0	--	--	--	--	--
		February	4.0-6.0	> 6.0	--	--	--	--	--
		March	4.0-6.0	> 6.0	--	--	--	--	--
		April	3.0-5.0	> 6.0	--	--	--	--	--
		May	3.0-5.0	> 6.0	--	--	--	--	--
		June	3.0-5.0	> 6.0	--	--	--	--	--

Table 22.--Water Features--(continued)

(Dashes (--) indicate that an assignment has not been made. Depths of layers are in feet)

Map symbol and soil name	Hydro-logic group	Month	Water Table: Upper limit	Water Table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
2228: (con't)									
Aylmer		July	4.0-6.0	> 6.0	--	--	--	--	--
		August	4.0-6.0	> 6.0	--	--	--	--	--
		September	4.0-6.0	> 6.0	--	--	--	--	--
		October	4.0-6.0	> 6.0	--	--	--	--	--
		November	4.0-6.0	> 6.0	--	--	--	--	--
		December	4.0-6.0	> 6.0	--	--	--	--	--
Rosewood	A/D								
		January	1.5-3.5	> 6.0	--	--	--	--	--
		February	1.5-3.5	> 6.0	--	--	--	--	--
		March	0.0-1.5	> 6.0	--	--	--	--	--
		April	0.0-1.5	> 6.0	--	--	--	--	--
		May	0.0-1.5	> 6.0	--	--	--	--	--
		June	0.0-1.5	> 6.0	--	--	--	--	--
		July	0.0-1.5	> 6.0	--	--	--	--	--
		August	1.5-3.5	> 6.0	--	--	--	--	--
		September	1.5-3.5	> 6.0	--	--	--	--	--
		October	1.5-3.5	> 6.0	--	--	--	--	--
		November	1.5-3.5	> 6.0	--	--	--	--	--
		December	1.5-3.5	> 6.0	--	--	--	--	--
Serden	A								
		All months	--	--	--	--	--	--	--

[1] A perched and apparent water table co-exist during these months.

Table 23.—Soil Features

(Dashes (—) indicate that an assignment has not been made.)

Map symbol and soil name	Restrictive layer				Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Initial	Total		Uncoated steel	Concrete
		In	In		In	In			
64:									
Arveson	—	—	—	—	0	—	High	High	Low
76:									
Arvilla	—	—	—	—	0	—	Low	Moderate	Low
86:									
Aylmer	—	—	—	—	0	—	Low	Moderate	Low
Bantry	—	—	—	—	0	—	Low	Moderate	Low
118:									
Barnes	—	—	—	—	0	—	Moderate	Moderate	Low
Buse	—	—	—	—	0	—	Moderate	Moderate	Low
120:									
Barnes	—	—	—	—	0	—	Moderate	Moderate	Low
Buse	—	—	—	—	0	—	Moderate	Moderate	Low
154:									
Barnes	—	—	—	—	0	—	Moderate	Moderate	Low
Svea	—	—	—	—	0	—	Moderate	High	Low
156:									
Barnes	—	—	—	—	0	—	Moderate	Moderate	Low
Svea	—	—	—	—	0	—	Moderate	High	Low
314:									
Buse	—	—	—	—	0	—	Moderate	Moderate	Low
Barnes	—	—	—	—	0	—	Moderate	Moderate	Low
450:									
Colvin	—	—	—	—	0	—	High	High	Low
493:									
Darnen	—	—	—	—	0	—	Moderate	High	Low
510:									
Divide	—	—	—	—	0	—	Moderate	High	Low
571:									
Embden	—	—	—	—	0	—	Moderate	Moderate	Low
726:									
Fordville	—	—	—	—	0	—	Low	Moderate	Low
772:									
Gardena	—	—	—	—	0	—	High	Moderate	Low
Eckman	—	—	—	—	0	—	High	Moderate	Low
794:									
Glyndon	—	—	—	—	0	—	High	High	Low

Table 23.--Soil Features--(continued)

(Dashes (--) indicate that an assignment has not been made.)

Map symbol and soil name	Restrictive layer: Kind	Restrictive layer: Depth to top	Restrictive layer: Thickness	Restrictive layer: Hardness	Subsidence: Initial	Subsidence: Total	Potential for frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
		In	In		In	In			
795:									
Glyndon, saline	--	--	--	--	0	--	High	High	Moderate
852:									
Hamar	--	--	--	--	0	--	Moderate	High	Low
883:									
Hamerly	--	--	--	--	0	--	High	High	Low
Tonka	--	--	--	--	0	--	High	High	Low
Parnell	--	--	--	--	0	--	High	High	Low
939:									
Hecla	--	--	--	--	0	--	Moderate	Low	Low
Hamar	--	--	--	--	0	--	Moderate	High	Low
1030:									
Kranzburg	--	--	--	--	0	--	High	High	Moderate
Lismore	--	--	--	--	0	--	High	High	Moderate
1043:									
La Prairie	--	--	--	--	0	--	Moderate	Moderate	Low
1055:									
LaDelle	--	--	--	--	0	--	High	High	Low
1081:									
Lamoure	--	--	--	--	0	--	High	High	Moderate
1168:									
Lismore	--	--	--	--	0	--	High	High	Moderate
Kranzburg	--	--	--	--	0	--	High	High	Moderate
1205:									
Maddock	--	--	--	--	0	--	Low	Low	Low
1221:									
Maddock	--	--	--	--	0	--	Low	Low	Low
Hecla	--	--	--	--	0	--	Moderate	Low	Low
1269:									
Marysland	--	--	--	--	0	--	High	High	Low
1403:									
Overly	--	--	--	--	0	--	High	High	Low
1427:									
Parnell	--	--	--	--	0	--	High	High	Low
1466:									
Pits, gravel and sand	--	--	--	--	0	--	None	Low	Low
1472:									
Rauville	--	--	--	--	0	--	High	High	Moderate

Table 23.—Soil Features--(continued)

(Dashes (—) indicate that an assignment has not been made.)

Map symbol and soil name	Restrictive layer: Kind	Restrictive layer: Depth to top	Restrictive layer: Thickness	Restrictive layer: Hardness	Subsidence: Initial	Subsidence: Total	Potential for frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
		In	In		In	In			
1523:									
Renshaw	—	—	—	—	0	—	Low	Moderate	Low
1560:									
Rifle	—	—	—	—	0	—	High	High	Low
1577:									
Rosewood	—	—	—	—	0	—	High	High	Low
1648:									
Serden	—	—	—	—	0	—	Low	Moderate	Low
Duneland	—	—	—	—	0	—	Low	Moderate	Low
1670:									
Ulen	—	—	—	—	0	—	Moderate	Low	Low
Rosewood	—	—	—	—	0	—	High	High	Low
1704:									
Sioux	—	—	—	—	0	—	Low	Low	Low
Renshaw	—	—	—	—	0	—	Low	Moderate	Low
1709:									
Southam	—	—	—	—	0	—	High	High	Low
1772:									
Svea	—	—	—	—	0	—	Moderate	High	Low
Gardena	—	—	—	—	0	—	High	Moderate	Low
1788:									
Swenoda	—	—	—	—	0	—	Moderate	High	Low
Barnes	—	—	—	—	0	—	Moderate	Moderate	Low
1834:									
Tonka	—	—	—	—	0	—	High	High	Low
1842:									
Towner	—	—	—	—	0	—	Moderate	High	Low
1859:									
Ulen	—	—	—	—	0	—	Moderate	Low	Low
1871:									
Vallers, saline	—	—	—	—	0	—	High	High	Moderate
1883:									
Vallers	—	—	—	—	0	—	High	High	Low
Parnell	—	—	—	—	0	—	High	High	Low
1935:									
Venlo	—	—	—	—	0	—	Moderate	High	Low
1953:									
Wahpeton	—	—	—	—	0	—	High	High	Low

Table 23.--Soil Features--(continued)

(Dashes (--) indicate that an assignment has not been made.)

Map symbol and soil name	Restrictive layer: Kind	Restrictive layer: Depth to top	Restrictive layer: Thickness	Restrictive layer: Hardness	Subsidence: Initial	Subsidence: Total	Potential for frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
		In	In		In	In			
1978:									
Water	--	--	--	--	--	--	--	--	--
2049:									
Wyndmere	--	--	--	--	0	--	High	Moderate	Low
2091:									
Zell	--	--	--	--	0	--	High	Low	Low
2206:									
Barnes	--	--	--	--	0	--	Moderate	Moderate	Low
Sioux	--	--	--	--	0	--	Low	Low	Low
2207:									
Bearden	--	--	--	--	0	--	High	High	Low
2208:									
Brantford	--	--	--	--	0	--	Low	Low	Low
Coe	--	--	--	--	0	--	Low	Low	Low
2209:									
Buse	--	--	--	--	0	--	Moderate	Moderate	Low
Barnes	--	--	--	--	0	--	Moderate	Moderate	Low
2210:									
Cathay	--	--	--	--	0	--	Moderate	High	Moderate
Larson	--	--	--	--	0	--	Moderate	High	Moderate
2211:									
Eckman	--	--	--	--	0	--	High	Moderate	Low
Gardena	--	--	--	--	0	--	High	Moderate	Low
2212:									
Eckman	--	--	--	--	0	--	High	Moderate	Low
Zell	--	--	--	--	0	--	High	Low	Low
2213:									
Eckman	--	--	--	--	0	--	High	Moderate	Low
Zell	--	--	--	--	0	--	High	Low	Low
2214:									
Exline	--	--	--	--	0	--	Moderate	High	High
2215:									
Fairdale	--	--	--	--	0	--	Moderate	Moderate	Low
2216:									
Gwinner	--	--	--	--	0	--	High	High	Low
Peever	--	--	--	--	0	--	Moderate	High	Moderate
Parnell	--	--	--	--	0	--	High	High	Low

Table 23.--Soil Features--(continued)

(Dashes (--) indicate that an assignment has not been made.)

Map symbol and soil name	Restrictive layer: Kind	Restrictive layer: Depth to top	Restrictive layer: Thickness	Restrictive layer: Hardness	Subsidence: Initial	Subsidence: Total	Potential for frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
		In	In		In	In			
2217:									
Hamerly	--	--	--	--	0	--	High	High	Low
Buse	--	--	--	--	0	--	Moderate	Moderate	Low
Parnell	--	--	--	--	0	--	High	High	Low
2218:									
Brantford	--	--	--	--	0	--	Low	Low	Low
Vang	--	--	--	--	0	--	Moderate	High	Low
2219:									
Hegne	--	--	--	--	0	--	High	High	Low
2220:									
Letcher	--	--	--	--	0	--	Moderate	High	Moderate
Lemert	--	--	--	--	0	--	Moderate	High	Moderate
2221:									
Falsen	--	--	--	--	0	--	Low	Moderate	Low
2222:									
Peever	--	--	--	--	0	--	Moderate	High	Moderate
Gwinner	--	--	--	--	0	--	High	High	Low
2223:									
Renshaw	--	--	--	--	0	--	Low	Moderate	Low
Sioux	--	--	--	--	0	--	Low	Low	Low
2224:									
Serden	--	--	--	--	0	--	Low	Moderate	Low
Hamar	--	--	--	--	0	--	Moderate	High	Low
2225:									
Sioux	--	--	--	--	0	--	Low	Low	Low
2226:									
Stirum	--	--	--	--	0	--	Moderate	High	Moderate
Lemert	--	--	--	--	0	--	Moderate	High	Moderate
2228:									
Aylmer	--	--	--	--	0	--	Low	Moderate	Low
Rosewood	--	--	--	--	0	--	High	High	Low
Serden	--	--	--	--	0	--	Low	Moderate	Low

Table 24.—Hydric Soils List

See end of table for criteria codes and definitions.

There may be small areas of included soils or miscellaneous areas that are significant to use and management of the soil; yet are too small to delineate on the soil map at the map's original scale. These may be designated as spot symbols and are described on the conventional and special symbols legend.

Map symbol and map unit name	Component	Hydric	Local landform	Hydric soils criteria: Hydric criteria code	Meets saturation criteria	Meets flooding criteria	Meets ponding criteria
64:							
Arveson loam	Arveson	Yes	flat	2B3	Yes	No	No
	Wyndmere	No	—	—	—	—	—
	Borup	Yes	depression	2B3	Yes	No	No
	Divide	No	—	—	—	—	—
	Glyndon	No	—	—	—	—	—
	Stirum	Yes	flat	2B3,3	Yes	No	Yes
	Tiffany	Yes	depression	2B3,3	Yes	No	Yes
76:							
Arvilla sandy loam, 0 to 6 percent slopes	Arvilla	No	—	—	—	—	—
	Brantford	No	—	—	—	—	—
	Fordville	No	—	—	—	—	—
	Divide	No	—	—	—	—	—
	Embden	No	—	—	—	—	—
	Hecla	No	—	—	—	—	—
	Sioux	No	—	—	—	—	—
86:							
Aylmer-Bantry fine sands, 0 to 6 percent slopes	Aylmer	No	—	—	—	—	—
	Bantry	No	—	—	—	—	—
	Hamar, poorly drained	Yes	flat	2B2	Yes	No	No
	Hecla	No	—	—	—	—	—
	Serden	No	—	—	—	—	—
	Towner	No	—	—	—	—	—
	Rosewood	Yes	depression	2B3	Yes	No	No
	Ulen	No	—	—	—	—	—
118:							
Barnes-Buse loams, 3 to 6 percent slopes	Barnes	No	—	—	—	—	—
	Buse	No	—	—	—	—	—
	Svea	No	—	—	—	—	—
	Hamerly	No	—	—	—	—	—
	Tonka	Yes	depression	2B3,3	Yes	No	Yes
120:							
Barnes-Buse loams, 6 To 9 percent slopes	Barnes	No	—	—	—	—	—
	Buse	No	—	—	—	—	—
	Svea	No	—	—	—	—	—
	Tonka	Yes	depression	2B3,3	Yes	No	Yes
	Zell	No	—	—	—	—	—
154:							
Barnes-Svea loams, 0 to 3 percent slopes	Barnes	No	—	—	—	—	—
	Svea	No	—	—	—	—	—
	Hamerly	No	—	—	—	—	—
	Tonka	Yes	depression	2B3,3	Yes	No	Yes
	Buse	No	—	—	—	—	—
	Parnell	Yes	depression	2B3,3	Yes	No	Yes

Table 24.--Hydric Soils List--(continued)

See end of table for criteria codes and definitions.

There may be small areas of included soils or miscellaneous areas that are significant to use and management of the soil; yet are too small to delineate on the soil map at the map's original scale. These may be designated as spot symbols and are described on the conventional and special symbols legend.

Map symbol and map unit name	Component	Hydric	Local landform	Hydric soils criteria			
				Hydric criteria code	Meets saturation criteria	Meets flooding criteria	Meets ponding criteria
156:							
Barnes-Svea loams, 3 to 6 percent slopes	Barnes	No	--	--	--	--	--
	Svea	No	--	--	--	--	--
	Buse	No	--	--	--	--	--
	Tonka	Yes	depression	2B3,3	Yes	No	Yes
	Parnell	Yes	depression	2B3,3	Yes	No	Yes
	Hamerly	No	--	--	--	--	--
	Vallers	Yes	flat	2B3	Yes	No	No
314:							
Buse-Barnes loams, 9 to 15 percent slopes	Buse	No	--	--	--	--	--
	Barnes	No	--	--	--	--	--
	Svea	No	--	--	--	--	--
	Darnen	No	--	--	--	--	--
	Tonka	Yes	depression	2B3,3	Yes	No	Yes
450:							
Colvin silt loam	Colvin	Yes	lake plain	2B3	Yes	No	No
	Borup	Yes	depression	2B3	Yes	No	No
	Marysland	Yes	flat	2B3	Yes	No	No
	Parnell	Yes	depression	2B3,3	Yes	No	Yes
	Divide	No	--	--	--	--	--
	Perella	Yes	depression	2B3,3	Yes	No	Yes
493:							
Darnen loam, 3 to 6 percent slopes	Darnen	No	--	--	--	--	--
	Svea	No	--	--	--	--	--
	Barnes	No	--	--	--	--	--
	Sioux	No	--	--	--	--	--
510:							
Divide loam	Divide	No	--	--	--	--	--
	Marysland	Yes	flat	2B3	Yes	No	No
	Hamerly	No	--	--	--	--	--
	Renshaw	No	--	--	--	--	--
	Spottswood	No	--	--	--	--	--
	Arveson	Yes	flat	2B3	Yes	No	No
	Parnell	Yes	depression	2B3,3	Yes	No	Yes
571:							
Embden fine sandy loam, 0 to 6 percent slopes	Embden	No	--	--	--	--	--
	Clontarf	No	--	--	--	--	--
	Egeland	No	--	--	--	--	--
	Hecla	No	--	--	--	--	--
	Wyndmere	No	--	--	--	--	--
	Svea	No	--	--	--	--	--
	Tiffany	Yes	depression	2B3,3	Yes	No	Yes
726:							
Fordville loam	Fordville	No	--	--	--	--	--
	Renshaw	No	--	--	--	--	--
	Svea	No	--	--	--	--	--
	Divide	No	--	--	--	--	--

Table 24.--Hydric Soils List--(continued)

See end of table for criteria codes and definitions.

There may be small areas of included soils or miscellaneous areas that are significant to use and management of the soil; yet are too small to delineate on the soil map at the map's original scale. These may be designated as spot symbols and are described on the conventional and special symbols legend.

Map symbol and map unit name	Component	Hydric	Local landform	Hydric soils criteria: Hydric criteria code	Meets saturation criteria	Meets flooding criteria	Meets ponding criteria
726: (con't)							
Fordville loam	Arvilla	No	--	--	--	--	--
	Sioux	No	--	--	--	--	--
772:							
Gardena-Eckman loams, 0 to 3 percent slopes	Gardena	No	--	--	--	--	--
	Eckman	No	--	--	--	--	--
	Overly	No	--	--	--	--	--
	Glyndon	No	--	--	--	--	--
	Zell	No	--	--	--	--	--
794:							
Glyndon loam	Glyndon	No	--	--	--	--	--
	Bearden	No	--	--	--	--	--
	Totten	Yes	depression	2B3	Yes	No	No
	Arveson	Yes	flat	2B3	Yes	No	No
	Embden	No	--	--	--	--	--
	Perella	Yes	depression	2B3,3	Yes	No	Yes
	Stirum	Yes	flat	2B3	Yes	No	No
795:							
Glyndon loam, saline	Glyndon, saline	No	--	--	--	--	--
	Bearden, saline	No	--	--	--	--	--
	Wyndmere	No	--	--	--	--	--
	Arveson	Yes	flat	2B3	Yes	No	No
852:							
Hamar loamy fine sand	Hamar	Yes	flat	2B3	Yes	No	No
	Hamar, somewhat poorly drained	No	--	--	--	--	--
	Hecla	No	--	--	--	--	--
	Ulen	No	--	--	--	--	--
883:							
Hamerly-Tonka-Parnell complex, 0 to 3 percent slopes	Hamerly	No	--	--	--	--	--
	Tonka	Yes	depression	2B3,3	Yes	No	Yes
	Parnell	Yes	depression	2B3,3	Yes	No	Yes
	Svea	No	--	--	--	--	--
	Barnes	No	--	--	--	--	--
	Vallers	Yes	flat	2B3	Yes	No	No
	Buse	No	--	--	--	--	--
	Cresbard	No	--	--	--	--	--
	Perella	Yes	depression	2B3,3	Yes	No	Yes
939:							
Hecla-Hamar loamy fine sands, 0 to 3 percent slopes	Hecla	No	--	--	--	--	--
	Hamar	No	--	--	--	--	--
	Ulen	No	--	--	--	--	--
	Aylmer	No	--	--	--	--	--

Table 24.--Hydric Soils List--(continued)

See end of table for criteria codes and definitions.

There may be small areas of included soils or miscellaneous areas that are significant to use and management of the soil; yet are too small to delineate on the soil map at the map's original scale. These may be designated as spot symbols and are described on the conventional and special symbols legend.

Map symbol and map unit name	Component	Hydric	Local landform	Hydric soils criteria: Hydric criteria code	Meets saturation criteria	Meets flooding criteria	Meets ponding criteria
939: (con't)							
Hecla-Hamar loamy fine sands, 0 to 3 percent slopes	Maddock	No	—	—	—	—	—
	Hamar, poorly drained	Yes	flat	2B3	Yes	No	No
	Rosewood	Yes	depression	2B3	Yes	No	No
	Wyndmere	No	—	—	—	—	—
1030:							
Kranzburg-Lismore silty clay loams, 2 to 6 percent slopes	Kranzburg	No	—	—	—	—	—
	Lismore	No	—	—	—	—	—
	Buse	No	—	—	—	—	—
	Hamerly	No	—	—	—	—	—
	Tonka	Yes	depression	2B3,3	Yes	No	Yes
1043:							
La Prairie loam	La Prairie	No	—	—	—	—	—
	Fairdale	No	—	—	—	—	—
	Fordville	No	—	—	—	—	—
	La Prairie, channeled	No	—	—	—	—	—
	Rauville	Yes	oxbow	2B3,4	Yes	Yes	No
1055:							
LaDelle silt loam	LaDelle	No	—	—	—	—	—
	Lamoure	Yes	flood plain	2B3	Yes	No	No
	La Prairie	No	—	—	—	—	—
	LaDelle, channeled	No	—	—	—	—	—
	Rauville	Yes	oxbow	2B3,4	Yes	Yes	No
1081:							
Lamoure silt loam	Lamoure	Yes	flood plain	2B3	Yes	No	No
	Colvin	Yes	lake plain	2B3	Yes	No	No
	Lamoure, channeled	Yes	flood plain	2B3	Yes	No	No
	Marysland	Yes	flat	2B3	Yes	No	No
	Darnen	No	—	—	—	—	—
	LaDelle	No	—	—	—	—	—
	Rauville	Yes	oxbow	2B3,4	Yes	Yes	No
1168:							
Lismore-Kranzburg silty clay loams, 0 to 2 percent slopes	Lismore	No	—	—	—	—	—
	Kranzburg	No	—	—	—	—	—
	Hamerly	No	—	—	—	—	—
	Tonka	Yes	depression	2B3,3	Yes	No	Yes
	Great Bend	No	—	—	—	—	—
1205:							
Maddock loamy fine sand, 6 to 15 percent slopes	Maddock	No	—	—	—	—	—
	Arvilla	No	—	—	—	—	—
	Fordville	No	—	—	—	—	—
	Hecla	No	—	—	—	—	—

Table 24.--Hydric Soils List--(continued)

See end of table for criteria codes and definitions.

There may be small areas of included soils or miscellaneous areas that are significant to use and management of the soil; yet are too small to delineate on the soil map at the map's original scale. These may be designated as spot symbols and are described on the conventional and special symbols legend.

Map symbol and map unit name	Component	Hydric	Local landform	Hydric soils criteria: Hydric criteria code	Meets saturation criteria	Meets flooding criteria	Meets ponding criteria
1205:							
Maddock loamy fine sand, 6 to 15 percent slopes	Dickey	No	--	--	--	--	--
	Serden	No	--	--	--	--	--
	Barnes	No	--	--	--	--	--
1221:							
Maddock-Hecla loamy fine sands, 1 to 6 percent slopes	Maddock	No	--	--	--	--	--
	Hecla	No	--	--	--	--	--
	Hamar, poorly drained	Yes	flat	2B2	Yes	No	No
	Aylmer	No	--	--	--	--	--
	Serden	No	--	--	--	--	--
	Buse	No	--	--	--	--	--
	Ulen	No	--	--	--	--	--
1269:							
Marysland silt loam	Marysland	Yes	flat	2B3	Yes	No	No
	Divide	No	--	--	--	--	--
1403:							
Overly silty clay loam	Overly	No	--	--	--	--	--
	Great Bend	No	--	--	--	--	--
	Gardena	No	--	--	--	--	--
	Bearden	No	--	--	--	--	--
	Perella	Yes	depression	2B3,3	Yes	No	Yes
	Tonka	Yes	depression	2B3,3	Yes	No	Yes
1427:							
Parnell silty clay loam	Parnell	Yes	depression	2B3,3	Yes	No	Yes
	Vallers	Yes	flat	2B3	Yes	No	No
	Southam	Yes	depression	2B3,3	Yes	No	Yes
	Tonka	Yes	depression	2B3,3	Yes	No	Yes
1466:							
Pits, gravel and sand	Pits, gravel and sand	No	--	--	--	--	--
	Renshaw	No	--	--	--	--	--
	Sioux	No	--	--	--	--	--
1472:							
Rauville silty clay loam	Rauville	Yes	oxbow	2B3,4	Yes	Yes	No
	Marysland	Yes	flat	2B3	Yes	No	No
	Lamoure	Yes	flood plain	2B3	Yes	No	No
1523:							
Renshaw loam, 0 to 3 percent slopes	Renshaw	No	--	--	--	--	--
	Sioux	No	--	--	--	--	--
	Fordville	No	--	--	--	--	--
1560:							
Rifle mucky peat	Rifle	Yes	depression	1,3	No	No	Yes
	Rauville	Yes	oxbow	2B3,4	Yes	Yes	No
	Water	Yes	depression	2B3,3	Yes	No	Yes

Table 24.--Hydric Soils List--(continued)

See end of table for criteria codes and definitions.

There may be small areas of included soils or miscellaneous areas that are significant to use and management of the soil; yet are too small to delineate on the soil map at the map's original scale. These may be designated as spot symbols and are described on the conventional and special symbols legend.

Map symbol and map unit name	Component	Hydric	Local landform	Hydric soils criteria: Hydric criteria code	Meets saturation criteria	Meets flooding criteria	Meets ponding criteria
1577:							
Rosewood fine sandy loam	Rosewood	Yes	flat	2B3	Yes	No	No
	Fossum	Yes	flat	2B3	Yes	No	No
	Ulen	No	--	--	--	--	--
	Rosewood	Yes	flat	2B3	Yes	No	No
	Venlo	Yes	depression	2B2	Yes	No	No
1648:							
Serden-Duneland complex, 1 to 35 percent slopes	Serden	No	--	--	--	--	--
	Duneland	No	--	--	--	--	--
	Blown-out land	No	--	--	--	--	--
	Minnewaukan	Yes	flat	2B2	Yes	No	No
	Aylmer	No	--	--	--	--	--
	Bantry	No	--	--	--	--	--
1670:							
Ulen-Rosewood fine sandy loams	Ulen	No	--	--	--	--	--
	Rosewood	Yes	depression	2B3	Yes	No	No
	Fossum	Yes	flat	2B3	Yes	No	No
	Hamar, poorly drained	Yes	flat	2B3	Yes	No	No
	Wyndmere	No	--	--	--	--	--
1704:							
Sioux-Renshaw complex, 0 to 6 percent slopes	Sioux	No	--	--	--	--	--
	Renshaw	No	--	--	--	--	--
	Arvilla	No	--	--	--	--	--
	Divide	No	--	--	--	--	--
1709:							
Southam silt loam	Southam	Yes	depression	2B3,3	Yes	No	Yes
	Parnell	Yes	depression	2B3,3	Yes	No	Yes
	Vallers	Yes	flat	2B3	Yes	No	No
1772:							
Svea-Gardena loams	Svea	No	--	--	--	--	--
	Gardena	No	--	--	--	--	--
	Embden	No	--	--	--	--	--
	Barnes	No	--	--	--	--	--
	Cresbard	No	--	--	--	--	--
	Lankin	No	--	--	--	--	--
	Buse	No	--	--	--	--	--
	Hamerly	No	--	--	--	--	--
1788:							
Swenoda-Barnes complex, 0 to 6 percent slopes	Swenoda	No	--	--	--	--	--
	Barnes	No	--	--	--	--	--
	Embden	No	--	--	--	--	--
	Svea	No	--	--	--	--	--
	Buse	No	--	--	--	--	--
	Towner	No	--	--	--	--	--

Table 24.—Hydric Soils List--(continued)

See end of table for criteria codes and definitions.

There may be small areas of included soils or miscellaneous areas that are significant to use and management of the soil; yet are too small to delineate on the soil map at the map's original scale. These may be designated as spot symbols and are described on the conventional and special symbols legend.

Map symbol and map unit name	Component	Hydric	Local landform	Hydric soils criteria: Hydric criteria code	Meets saturation criteria	Meets flooding criteria	Meets ponding criteria
1834:							
Tonka silt loam	Tonka	Yes	depression	2B3,3	Yes	No	Yes
	Hamerly	No	—	—	—	—	—
	Vallers	Yes	flat	2B3	Yes	No	No
1842:							
Towner loamy fine sand, 0 to 3 percent slopes	Towner	No	—	—	—	—	—
	Lohnes	No	—	—	—	—	—
	Maddock	No	—	—	—	—	—
	Arvilla	No	—	—	—	—	—
	Fordville	No	—	—	—	—	—
	Hamar, poorly drained	Yes	flat	2B2	Yes	No	No
	Hecla	No	—	—	—	—	—
1859:							
Ulen fine sandy loam	Ulen	No	—	—	—	—	—
	Rosewood	Yes	depression	2B3	Yes	No	No
	Hamar, poorly drained	Yes	flat	2B3	Yes	No	No
	Wyndmere	No	—	—	—	—	—
	Divide	No	—	—	—	—	—
	Aylmer	No	—	—	—	—	—
	Hecla	No	—	—	—	—	—
1871:							
Vallers loam, saline	Vallers, saline	Yes	flat	2B3	Yes	No	No
	Hamerly, saline	No	—	—	—	—	—
	Parnell	Yes	depression	2B3,3	Yes	No	Yes
	Easby	Yes	flat	2B3	Yes	No	No
	Vallers	Yes	flat	2B3	Yes	No	No
	Tonka	Yes	depression	2B3,3	Yes	No	Yes
1883:							
Vallers-Parnell complex	Vallers	Yes	flat	2B3	Yes	No	No
	Parnell	Yes	depression	2B3,3	Yes	No	Yes
	Hamerly	No	—	—	—	—	—
	Vallers, saline	Yes	flat	2B3	Yes	No	No
	Divide	No	—	—	—	—	—
	Tonka	Yes	depression	2B3,3	Yes	No	Yes
1935:							
Venlo fine sandy loam	Venlo	Yes	depression	2B2	Yes	No	No
	Rosewood	Yes	depression	2B3	Yes	No	No
	Fossum	Yes	flat	2B3	Yes	No	No
	Ulen	No	—	—	—	—	—
	Rauville	Yes	oxbow	2B3,4	Yes	Yes	No

Table 24.--Hydric Soils List--(continued)

See end of table for criteria codes and definitions.

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Map symbol and map unit name	Component	Hydric	Local landform	Hydric soils criteria: Hydric criteria code	Meets saturation criteria	Meets flooding criteria	Meets ponding criteria
1953:							
Wahpeton silty clay	Wahpeton	No	--	--	--	--	--
	Lamoure	Yes	flood plain	2B3	Yes	No	No
	LaDelle	No	--	--	--	--	--
1978:							
Water	Water	Yes	depression	2B3,3	Yes	No	Yes
2049:							
Wyndmere loam	Wyndmere	No	--	--	--	--	--
	Divide	No	--	--	--	--	--
	Tiffany	No	--	--	--	--	--
	Arveson	Yes	flat	2B3	Yes	No	No
	Embden	No	--	--	--	--	--
	Tonka	Yes	depression	2B3,3	Yes	No	Yes
	Stirum	Yes	flat	2B3	Yes	No	No
2091:							
Zell loam, 9 to 25 percent slopes	Zell	No	--	--	--	--	--
	Buse	No	--	--	--	--	--
	Eckman	No	--	--	--	--	--
	Gardena	No	--	--	--	--	--
	Langhei	No	--	--	--	--	--
	Sioux	No	--	--	--	--	--
2206:							
Barnes-Sioux complex, 3 to 9 percent slopes	Barnes	No	--	--	--	--	--
	Sioux	No	--	--	--	--	--
	Buse	No	--	--	--	--	--
	Renshaw	No	--	--	--	--	--
	Svea	No	--	--	--	--	--
	Divide	No	--	--	--	--	--
	Egeland	No	--	--	--	--	--
	Hamerly	No	--	--	--	--	--
2207:							
Bearden silt loam	Bearden	No	--	--	--	--	--
	Glyndon	No	--	--	--	--	--
	Hegne	Yes	lake plain	2B3	Yes	No	No
	Overly	No	--	--	--	--	--
	Perella	Yes	depression	2B3,3	Yes	No	Yes
2208:							
Brantford-Coe loams, 1 to 6 percent slopes	Brantford	No	--	--	--	--	--
	Coe	No	--	--	--	--	--
	Vang	No	--	--	--	--	--
	Divide	No	--	--	--	--	--
	Renshaw	No	--	--	--	--	--

Table 24.--Hydric Soils List--(continued)

See end of table for criteria codes and definitions.

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Map symbol and map unit name	Component	Hydric	Local landform	Hydric soils criteria: Hydric criteria code	Meets saturation criteria	Meets flooding criteria	Meets ponding criteria
2209:							
Buse-Barnes loams, 15 to 50 percent slopes	Buse	No	--	--	--	--	--
	Barnes	No	--	--	--	--	--
	Svea	No	--	--	--	--	--
	Forman	No	--	--	--	--	--
	Sioux	No	--	--	--	--	--
	Maddock	No	--	--	--	--	--
2210:							
Cathay-Larson loams, bouldery	Cathay	No	--	--	--	--	--
	Larson	No	--	--	--	--	--
	Svea	No	--	--	--	--	--
	Divide	No	--	--	--	--	--
	Marysland	Yes	flat	2B3	Yes	No	No
	Totten	Yes	depression	2B3	Yes	No	No
	Arvilla	No	--	--	--	--	--
	Tonka	Yes	depression	2B3,3	Yes	No	Yes
2211:							
Eckman-Gardena loams, 3 to 6 percent slopes	Eckman	No	--	--	--	--	--
	Gardena	No	--	--	--	--	--
	Zell	No	--	--	--	--	--
	Embden	No	--	--	--	--	--
	Swenoda	No	--	--	--	--	--
2212:							
Eckman-Zell loams, 3 to 6 percent slopes	Eckman	No	--	--	--	--	--
	Zell	No	--	--	--	--	--
	Gardena	No	--	--	--	--	--
	Barnes	No	--	--	--	--	--
	Cresbard	No	--	--	--	--	--
	Tonka	Yes	depression	2B3,3	Yes	No	Yes
2213:							
Eckman-Zell loams, 6 to 9 percent slopes	Eckman	No	--	--	--	--	--
	Zell	No	--	--	--	--	--
	Gardena	No	--	--	--	--	--
	Buse	No	--	--	--	--	--
	Renshaw	No	--	--	--	--	--
2214:							
Exline loam	Exline	No	--	--	--	--	--
	Totten	Yes	depression	2B3	Yes	No	No
	Stirum	Yes	flat	2B3	Yes	No	No
	Hegne	Yes	lake plain	2B3	Yes	No	No
	Ryan	Yes	flood plain	2B3	Yes	No	No
	Aberdeen	No	--	--	--	--	--
	Bearden	No	--	--	--	--	--

Table 24.—Hydric Soils List--(continued)

See end of table for criteria codes and definitions.

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Map symbol and map unit name	Component	Hydric	Local landform	Hydric soils criteria: Hydric criteria code	Meets saturation criteria	Meets flooding criteria	Meets ponding criteria
2215:							
Fairdale loam, 0 to 6 percent slopes	Fairdale	No	—	—	—	—	—
	La Prairie	No	—	—	—	—	—
	Fairdale, channeled	No	—	—	—	—	—
	LaDelle	No	—	—	—	—	—
2216:							
Gwinner-Peever-Parnell complex, 0 to 3 percent slopes	Gwinner	No	—	—	—	—	—
	Peever	No	—	—	—	—	—
	Parnell	Yes	depression	2B3,3	Yes	No	Yes
	Cresbard	No	—	—	—	—	—
	Lismore	No	—	—	—	—	—
	Tonka	Yes	depression	2B3,3	Yes	No	Yes
	Hamerly	No	—	—	—	—	—
2217:							
Hamerly-Buse-Parnell complex, 0 to 6 percent slopes	Hamerly	No	—	—	—	—	—
	Buse	No	—	—	—	—	—
	Parnell	Yes	depression	2B3,3	Yes	No	Yes
	Svea	No	—	—	—	—	—
	Tonka	Yes	depression	2B3,3	Yes	No	Yes
	Vallers	Yes	flat	2B3	Yes	No	No
	Barnes	No	—	—	—	—	—
	Peever	No	—	—	—	—	—
2218:							
Brantford-Vang loams, 1 to 3 percent slopes	Brantford	No	—	—	—	—	—
	Vang	No	—	—	—	—	—
	Coe	No	—	—	—	—	—
	Renshaw	No	—	—	—	—	—
2219:							
Hegne silty clay loam	Hegne	Yes	lake plain	2B3	Yes	No	No
	Bearden	No	—	—	—	—	—
	Colvin	Yes	lake plain	2B3	Yes	No	No
	Overly	No	—	—	—	—	—
	Aberdeen	No	—	—	—	—	—
	Exline	No	—	—	—	—	—
2220:							
Letcher-Lemert sandy loams	Letcher	No	—	—	—	—	—
	Lemert	No	—	—	—	—	—
	Stirum	Yes	flat	2B3	Yes	No	No
	Arveson	Yes	flat	2B3	Yes	No	No
2221:							
Falsen loamy sand, 0 to 3 percent slopes	Falsen	No	—	—	—	—	—
	Maddock	No	—	—	—	—	—
	Claire	No	—	—	—	—	—
	Hecla	No	—	—	—	—	—

Table 24.--Hydric Soils List--(continued)

See end of table for criteria codes and definitions.

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Map symbol and map unit name	Component	Hydric	Local landform	Hydric soils criteria: Hydric criteria code	Meets saturation criteria	Meets flooding criteria	Meets ponding criteria
2222:							
Peever-Gwinner complex, 3 to 6 percent slopes	Peever	No	—	—	—	—	—
	Gwinner	No	—	—	—	—	—
	Forman	No	—	—	—	—	—
	Buse	No	—	—	—	—	—
	Hamerly	No	—	—	—	—	—
	Cresbard	No	—	—	—	—	—
	Parnell	Yes	depression	2B3,3	Yes	No	Yes
2223:							
Renshaw-Sioux complex, 0 to 6 percent slopes	Renshaw	No	—	—	—	—	—
	Sioux	No	—	—	—	—	—
	Fordville	No	—	—	—	—	—
	Arvilla	No	—	—	—	—	—
	Divide	No	—	—	—	—	—
2224:							
Serden-Hamar complex, 0 to 15 percent slopes	Serden	No	—	—	—	—	—
	Hamar	Yes	flat	2B3	Yes	No	No
	Aylmer	No	—	—	—	—	—
	Duneland	No	—	—	—	—	—
	Rosewood	Yes	depression	2B3	Yes	No	No
	Ulen	No	—	—	—	—	—
	Maddock	No	—	—	—	—	—
2225:							
Sioux cobbly sandy loam, 6 to 15 percent slopes	Sioux	No	—	—	—	—	—
	Renshaw	No	—	—	—	—	—
	Fordville	No	—	—	—	—	—
	Buse	No	—	—	—	—	—
2226:							
Stirum-Lemert sandy loams	Stirum	Yes	flat	2B3	Yes	No	No
	Lemert	No	—	—	—	—	—
	Totten	Yes	depression	2B3	Yes	No	No
	Letcher	No	—	—	—	—	—
	Arveson, saline	Yes	flat	2B3	Yes	No	No
	Glyndon	No	—	—	—	—	—
	Wyndmere	No	—	—	—	—	—
2228:							
Aylmer-Rosewood-Serden complex, 0 to 9 percent slopes	Aylmer	No	—	—	—	—	—
	Rosewood	Yes	depression	2B3	Yes	No	No
	Serden	No	—	—	—	—	—
	Ulen	No	—	—	—	—	—
	Bantry	No	—	—	—	—	—
	Fossum	Yes	flat	2B3	Yes	No	No
	Duneland	No	—	—	—	—	—

HYDRIC SOILS CRITERIA CODES AND DEFINITIONS

1. All Histosols, except Folists, or

2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Aquisalids, Pachic subgroups, or Cumulic subgroups that are:
   a. somewhat poorly drained with a water table equal to 0.0 foot from the surface during the growing season, or
   b. poorly drained or very poorly drained and have either:
      (1) water table equal to 0.0 feet from the surface during the growing season if textures are coarse sand, sand, or fine sand in all layers within 20 inches or for other soils
      (2) water table at less than or equal to 0.5 feet from the surface during the growing season if permeability is equal to or greater than 6.0 inches/hour in all layers within 20 inches, or
      (3) water table at less than or equal to 1.0 foot from the surface during the growing season if permeability is less than 6.0 inches/hour in any layer within 20 inches, or

3. Soils that are frequently ponded for long duration or very long duration during the growing season, or

4. Soils that are frequently flooded for long duration or very long duration during the growing season.

References

American Association of State Highway and Transportation Officials. 1986. Standard specifications for highway materials and methods of sampling and testing. Ed. 14, 2 vols.

American Society for Testing and Materials. 1993. Standard classification of soils for engineering purposes. ASTM Stand. D 2487.

Armstrong, C.A. 1982. Groundwater Resources of Ransom and Sargent Counties, North Dakota. North Dakota Geological Survey, Bull 69, Part III, and North Dakota State Water Commission Groundwater Studies 31, Part III.

Beard, L. W., and E. Waldhaus. 1997. North Dakota Agricultural Statistics - 1996. North Dakota Agric. Stat. Serv., Ag. Statistics No. 66. North Dakota State University and USDA-NASS.

Bluemle, J.P. 1979. Geology of Ransom and Sargent Counties, North Dakota. North Dakota Geological Survey Bulletin 69, Part I, and North Dakota State Water Commission Groundwater Studies 21, Part I.

Broderson, W., 1991. From the surface down: An introduction to soil surveys for agronomic use. USDA-SCS, National Soil Survey Center, Lincoln, NE.

Brubaker, S.C. and C. T. Hallmark, 1991. A Comparison of Statistical Methods for Evaluating Map Unit Composition. p. 73-88. In M.J. Mausbach and L.P. Wilding (ed.) Spatial Variabilities of Soils and Landforms. SSSA Special Publication Number 28 Soil Science Society of America, Inc. Madison, Wisconsin, USA.

Cowardin, L. M., V. Carter, F.C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deep-water habits of the United States. USDI-FWS. FWS/OSB-79/31.

Ely, Charles W., Rex E. Willard, and J.T. Weaver. 1906. Soil Survey of Ransom County, North Dakota. Bureau of Soils, USDA. US Govt. Print Office, Washington, DC.

Environmental Laboratory. 1987. Corps of Engineers Wetlands delineation manual. Tech. Rpt. Y-87-1. US Army Engineers Waterways Experiment Station, Vicksburg, MS.

Federal Register. July 13, 1994. Changes in hydric soils of the United States. Washington, DC.

Federal Register. February 24, 1995. Hydric soils of the United States, Washington, DC.

Franzen, D., C. Fanning, and T. Gregoire. 1994. Managing saline soils in North Dakota. North Dakota Agric. Ext. Ser. Bull. SF-1087.

Jakes, P.J. and W.B. Smith. 1982. A second look at North Dakota's timber land. ND For. Exp. Sta., USDA-FS, Res. Bull. ND-58.

Jensen, R. E., 1972. Climate of North Dakota. North Dakota State University, Fargo, ND.

National Research Council. 1995. Wetlands: Characteristics and boundaries. National Academy Press, Washington, D. C.

Omodt, H. W., G. A. Johnsgard, D. D. Patterson, and O. P. Olson. 1968. The major soils of North Dakota. North Dakota. Agric. Exp. Stn., Bull. 472.

Omodt, H.W., Fred W. Schroer, and C.R. Redmond, 1966. Soil survey of Tri-County Area, North Dakota. USDA-SCS. US Govt. Print. Office, Washington, DC.

Patterson, D. D., G. A. Johnsgard, M. D. Sweeney, and H. W. Omodt. 1968. Soil survey report, county general soil maps, North Dakota. North Dakota Agric. Exp. Stn., Bull. 473.

Seelig, B. D. 1993. Soil survey: The foundation for productive natural resource management. North Dakota Agric. Ext. Ser. Bull. 60.

Seelig, B. D. and J. L. Richardson. 1991. Salinity and sodicity in North Dakota soils. North Dakota Agric. Ext. Ser. Bull. EB57.

Soil Survey Staff. 1975. Soil Taxonomy: A basic system of soil classification for making and interpreting soil surveys. USDA-SCS Agric. Hand. 436, US Govt. Print. Office, Washington, DC.

Soil Survey Staff. 1993. Soil Survey Manual. USDA-SCS. Agric. Hand. 18. US Govt. Print. Office, Washington, DC.

Soil Survey Staff. 1996a. Keys to Soil Taxonomy. Seventh Edition. USDA-NRCS. US Govt. Print. Office, Washington, DC.

Soil Survey Staff. 1996b. National Soil Survey Handbook, Title 430-VI. USDA-NRCS. US Govt. Print. Office, Washington, DC.

Thompson, Donald G. and Lloyd L. Joos. 1975. Soil Survey of Richland County and Sheyenne National Grasslands Area of Ransom County, North Dakota. USDA-SCS. US Govt. Print. Office, Washington, DC.

Thorfinnson, S.M. 1975. Ransom County History. Ransom County Historical Society. Lisbon, ND.

Tiner, R.W., Jr. 1985. Wetlands of Delaware. USDI-FWS, Newton Corner, MA and Delaware Department of Natural Resources and Environmental Control, Wetlands Section, Dover, DE.

Ulmer, M.G. and D.D. Patterson. 1988a. Crop yield interpretation for North Dakota: I. Sequential sampling. Soil Surv. Horiz. 29:116-122.

Ulmer, M.G. and D.D. Patterson. 1988b. Crop yield interpretation for North Dakota: II. Field questionnaires: A delphi example. Soil Surv. Horiz. 29: 123-132.

Ulmer, M.G., D.D. Patterson, and J.W. Enz. 1988c. Crop yield interpretation for North Dakota: III. Long-term empirical models. Soil Surv. Horiz. 29: 132-141.

United States Department of Agriculture-National Agricultural Statistics Service. 1999. 1997 Census of agriculture. Vol. 1, Part 34, US Govt. Print. Office, Washington, DC

United States Department of Agriculture-Natural Resources Conservation Service. 1996. Field Indicators of Hydric Soils in the United States. G.W. Hurt, Whited, P.M., Pringle, R.F. (eds.). USDA-NRCS, Fort Worth, TX.

United States Department of Agriculture-Soil Conservation Serivce. 1992. Field Office Technical Guide. USDA-NRCS, Bismarck, ND.

United States Department of Agriculture-Natural Resources Conservation Service. 1994. State Soil Geographic Data Base. Misc.pub. 1492. USDA-NRCS, Fort Worth, TX.

United States Department of Agriculture-Soil Conservation Service. 1961. Land Capability Classification. USDA Handb. 210, US Govt. Print. Office, Washington, DC.

United States Department of Agriculture-Soil Conservation Service. 1981. Land resource regions and major land resource areas of the United States. Agric. Handb. 296, re. ed., US Govt. Print. Office, Washington, DC.

United States Department of Agriculture-Soil Quality Institute. 1998. Soil quality test kit guide.

Glossary

ABC soil. A soil having an A, a B, and a C horizon.

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Alpha, alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redoximorphic feature.

Animal-unit month (AUM). The amount of forage required by one mature cow weighing approximately 1,000 pounds, with or without a calf, for 1 month.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Atterberg Limits. A general term that encompasses liquid limit, plastic limit, and shrinkage limit. It is used as an integral part of several engineering classification systems.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Badland. Moderately steep to very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface. It may be either **lithic** (digging with a hand spade impractical) or **paralithic** (dug with difficulty with a spade).

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Butte. An isolated small mountain or hill with steep or precipitous sides and a top variously flat, rounded, or pointed that may be a residual mass isolated by erosion.

$CaCO_3$ Equivalent. The quantity of carbonate (CO_3) in the soil expressed as $CaCO_3$. This material is important to the fertility, erosion, available water holding capacity, and genesis of a soil.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channery soil material. Soil material that is, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions. Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

Collapsed lake plan. A previously nearly level surface marking the floor of an extinct lake, filled in by well-sorted deposits from inflowing streams and underlain by glacial ice, now having the surface configuration of the underlying topography as a result of melting of the glacial ice.

Collapsed outwash plain. A previously broad, flat, or gently sloping alluvial sheet of outwash deposited by meltwater streams and underlain by glacial ice, now having the surface configuration of the underlying topography as a result of melting of the glacial ice.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Conglomerate. A coarse grained, clastic rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose ..... noncoherent when dry or moist; does not hold together in a mass.

Friable ..... when moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm .... when moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic .... when wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky ...... when wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard ... when dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft .... when dry, breaks into powder or individual grains under very slight pressure.

Cemented .... hard, little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Contrasting soils (Dissimilar soils). Soils that do not share limits of diagnostic criteria, behave and perform in a similar manner, or have similar conservation needs or management requirements for the major land uses in the survey area.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Delta. A body of alluvium having a surface that is nearly flat and fan shaped; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming. A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized:

Excessively drained ..... these soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained .... these soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown and yields are low.

Well drained .... these soils have an intermediate water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained ... these soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of some field crops are adversely affected unless a drainage system is installed. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.. .... these soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless a drainage system is installed. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained .. .. these soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained .... these soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except rice) unless a drainage system is installed.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drainageway. An area of ground at a lower elevation than the surrounding ground and in which water collects and is drained to a closed depression or lake or to a drainageway at a lower elevation. A drainageway may or may not have distinctly incised channels at its upper reaches or throughout its course.

Draw. A small stream valley that generally is more open and has broader bottom land than a ravine or gulch.

Drift. A general term applied to all material transported by a glacier and deposited directly from the ice or by running water coming from the ice. Drift includes unstratified material (till) that forms moraines, and stratified glaciofluvial deposits that form outwash plains, eskers, kames, varves, and glaciolacustrine sediments. The term is generally applied to Pleistocene glacial deposits in areas that no longer contain glaciers.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers

to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

Esker. A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess sulfur (in tables). Excessive amount of sulfur in the soil. The sulfur causes extreme acidity if the soil is drained, and the growth of most plants is restricted.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called normal field capacity, normal moisture capacity, or capillary capacity.

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, or clay.

Flaggy soil material. Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flooding. The temporary covering of the soil surface by flowing water from any source.

Flooding frequency classes:

None........0 percent chance of flooding in any year.

Rare.. ...... .0 to 5 percent chance of flooding in any year.

Occasional.....5 to 50 percent chance of flooding in any year.

Frequent.....more than 50 percent chance of flooding in any year.

Flooding duration classes:

Extremely brief	0.1 to 4.0 hours
Very brief	4 to 48 hours
Brief	2 to 7 days
Long	7 to 30 days
Very long	more than 30 days

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (300 meters) and fringes a mountain range or high-plateau escarpment.

Foot slope. The bottom of a slope or the lower part of any elevated landform.

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

Glacial drift. Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash. Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits. Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage. A gullied map unit is one that has numerous gullies.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hardpan. A hardened or cemented soil horizon or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

O horizon......an organic layer of fresh and decaying plant residue.

A horizon......the mineral horizon at or near the surface in which an accumulation of humidified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon......the mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon......the mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon......the mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon......Soft, consolidated bedrock beneath the soil.

R layer......Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Hummock. A slight mound or rise of ground above a level surface; generally of equidimensional shape and not ridge-like.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydric soil. Soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions for the upper part.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a

clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin .... Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border. .... Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding .... Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation .... Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle). .... Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow .... Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler..... Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation ...... Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding .... Water, released at high points, is allowed to flow onto an area without controlled distribution.

K Factor. Soil erodibility factor in the Universal Soil Loss Equation.

Kame. An irregular, short ridge or hill of stratified glacial drift.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Ksat. See saturated hydraulic conductivity.

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake plain. A surface marking the floor of an extinct lake, filled in by well sorted, stratified sediments.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Lime. A soil material that consists of precipitated calcium or magnesium carbonate.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine. An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons,

and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance - few, common, and many; size - fine, medium, and coarse; and contrast - faint, distinct, and prominent. The size measurements are of the diameter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Mudstone. A blocky or massive, fine-grained sedimentary rock that consists of a mixture of clay, silt, and sand particles, the proportion of which vary from place to place.

Munsell notation. A designation of color by degrees of three simple variables - hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, hardpan, fragipan, claypan, plowpan, and traffic pan.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. See saturated hydraulic conductivity (Ksat).

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plateau. An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Very brief	less than 2 days
Brief	2 to 7 days
Long	7 to 30 days
Very long	more than 30 days

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Porcelanite (scoria). Shale and clay that are fused as a result of their proximity to a burning coal vein.

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Red beds. Sedimentary strata that are mainly red and are made up largely of sandstone and shale.

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma (2 or less) zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly

continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Retrogression. The process by which rangeland vegetation changes significantly from the natural potential plant community. syn., range deterioration, site deterioration.

Revised Universal Soil Loss Equation (RUSLE). An erosion model designed to predict the long term average soil loss carried by runoff from specific field slopes in specified cropping and management systems.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rock outcrop. Exposures of bare bedrock other than lava flows and rock-lined pits. Most rock outcrops are hard rock.

Root shearing. The cutting, tearing, and disruption of plant roots by the hooves of animals during grazing when the soil is wet and soft.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline seep. Areas of nonirrigated soils with restricted drainage, where salinity has recently developed.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Saline-sodic soil. A soil containing a combination of soluble salts and exchangeable sodium sufficient to interfere with the growth of plants.

Salty water (in tables). Water that is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Saturated hydraulic conductivity (Ksat). The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. Terms describing saturated hydraulic conductivity, measured in inches per hour, are as follows:

Extremely slow	0.0 to 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have

horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder slope. The uppermost inclined surface at the top of a hillside. It is the transition zone from the back slope to the summit of a hill or mountain. The surface is dominantly convex in profile and erosional in origin.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil generally is silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey, classes for simple slopes are as follows:

Level	0 to 1 percent
Level and nearly level	0 to 3 percent
Nearly level	1 to 3 percent
Gently sloping or undulating	3 to 6 percent
Moderately sloping or gently rolling	6 to 9 percent
Strongly sloping or rolling	9 to 15 percent
Moderately steep or hilly	15 to 25 percent
Steep	25 to 35 percent
Very steep	More than 35 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil depth class. The distance from the top of the soil to the underlying bedrock. The distance, in inches, is expressed as:

Very shallow	less than 10 inches
Shallow	10 to 20 inches
Moderately deep	20 to 40 inches
Deep	40 to 60 inches
Very deep	greater than 60 inches

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are - platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Talus. Fragments of rock and other soil material accumulated by gravity at the foot of cliffs or steep slopes.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are - sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam,

silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material that is too thin for the specified use.

Till plain. An extensive area of nearly level to undulating soils underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The lower gentle slope of a hillside. The lowest part of a foot slope.

Too arid (in tables). The soil is dry most of the time and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Universal Soil Loss Equation (USLE). An equation used to design water erosion control systems: **A-RKLSPC** where **A** is average annual soil loss in tons per acre per year; **R** is the rainfall factor; **K** is the soil erodibility factor; **L** is the length of slope; **S** is the percent slope; **P** is the conservation practice factor; and **C** is the cropping and management factor.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley. An elongated depressional area primarily developed by stream action.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Very deep soil. A soil that is more than 60 inches deep over bedrock or to other material that restricts the penetration of plant rows.

Very shallow soil. A soil that is less than 10 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Water table. The upper surface of groundwater or that level below the surface where the soil is saturated with water. For soil survey purposes, the depth the water table is observed is within 60 inches from the surface.

Apparent .... Level at which water stands in a freshly dug, unlined borehole after it has adequate time for adjustments in the surrounding soil.

Perched .... A saturated soil zone above an unsaturated layer in the soil.

Artesian .... A water table under hydrostatic head beneath an impermeable layer.

Seasonal .... A water table within 60 inches of the surface during the growing season.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windsculptured. A land surface of which its form has been changed by action of the wind.

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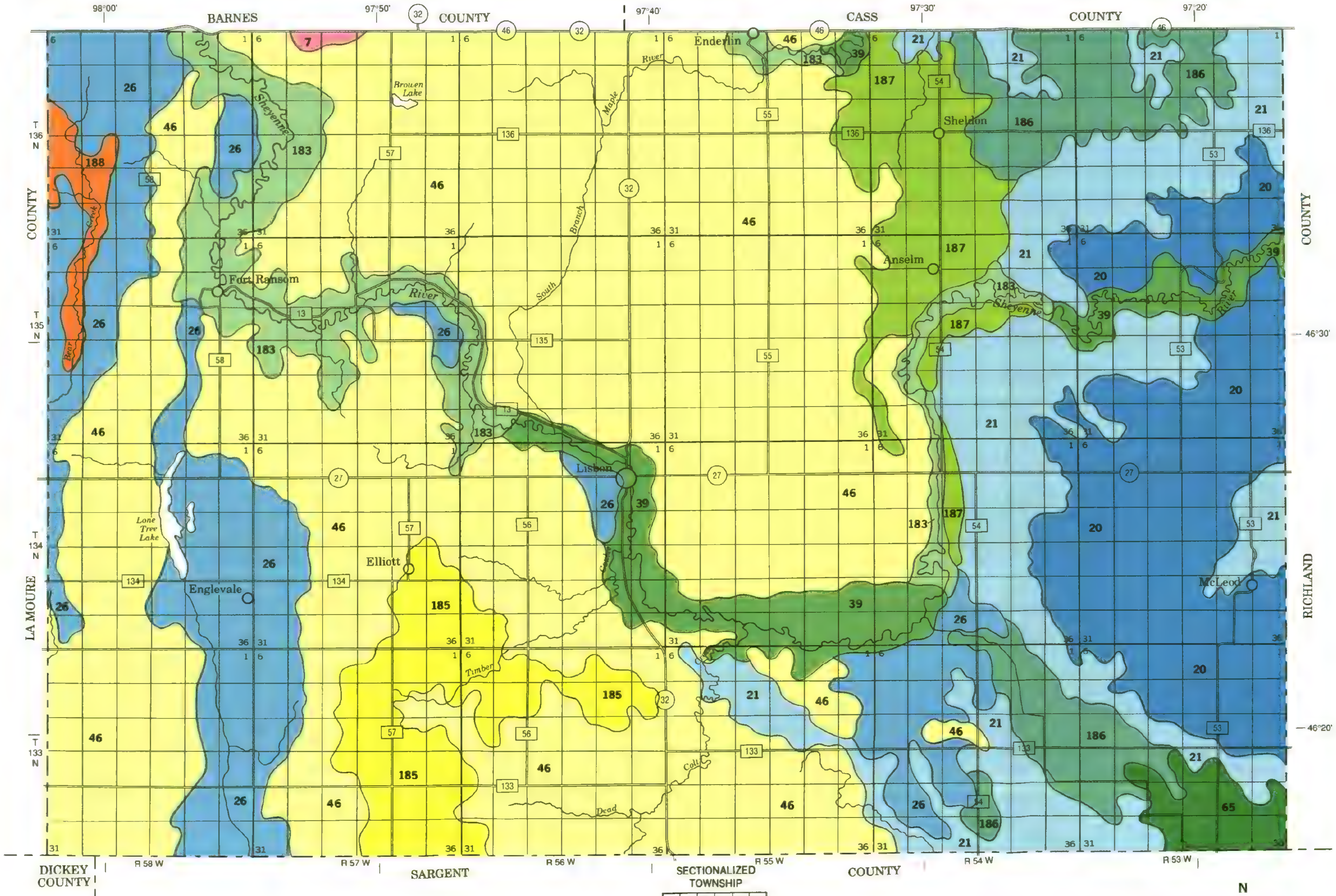


SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SOIL LEGEND*

- 7 Kranzburg-Lismore association, level and undulating
- 20 Serden-Aylmer-Rosewood association, level to steep
- 21 Hecla-Hamar-Ulen association, level and undulating
- 26 Renshaw-Hecla-Divide association, nearly level and undulating
- 39 LaPrairie-Renshaw-Buse association, nearly level to steep
- 46 Barnes-Svea-Hamerly association, level to gently rolling
- 65 Exline-Hegne-Stirum association, level and nearly level
- 183 LaDelle-Buse-Barnes-Edgeley association, level to steep
- 185 Gwinner-Hamerly-Parnell association, level and nearly level
- 186 Ulen-Wyndmere-Rosewood association, level
- 187 Svea-Gardena-Eckman association, nearly level and undulating
- 188 Cavour-Cathay-Renshaw association, level and nearly level

*The units on this legend are described in the text under the heading "General Soil Map Units."

Compiled 1998

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION
NORTH DAKOTA COOPERATIVE EXTENSION SERVICE
NORTH DAKOTA STATE SOIL CONSERVATION COMMITTEE

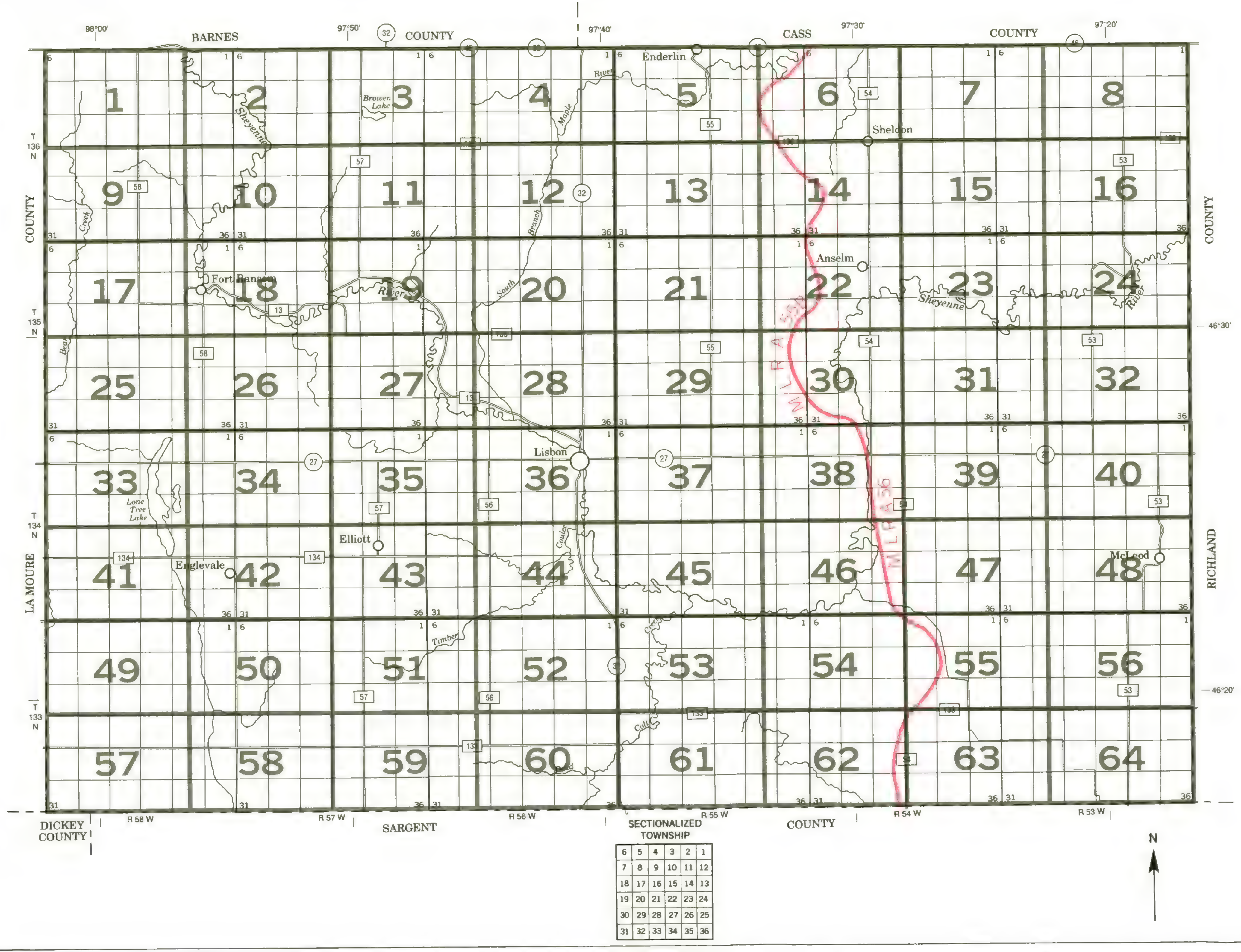
GENERAL SOIL MAP

RANSOM COUNTY, NORTH DAKOTA

Scale 1:190,080

1 0 1 2 3 Mi

1 0 3 6 Km



INDEX TO MAP SHEETS

RANSOM COUNTY, NORTH DAKOTA

Scale 1:190,080

1 0 1 2 3 Mi

1 0 3 6 Km

SOIL LEGEND

Map symbols consist of numbers that are part of the North Dakota State Soil Map Unit Legend.

SYMBOL	NAME
64	Arveson loam
76	Arvilla sandy loam, 0 to 6 percent slopes
86	Aylmer-Bantry fine sands, 0 to 6 percent slopes
118	Barnes-Buse loams, 3 to 6 percent slopes
120	Barnes-Buse loams, 6 to 9 percent slopes
154	Barnes-Svea loams, 0 to 3 percent slopes
156	Barnes-Svea loams, 3 to 6 percent slopes
314	Buse-Barnes loams, 9 to 15 percent slopes
450	Colvin silt loam
493	Darnen loam, 3 to 6 percent slopes
510	Divide loam
571	Embden fine sandy loam, 0 to 6 percent slopes
726	Fordville loam
772	Gardena-Eckman loams, 0 to 3 percent slopes
794	Glyndon loam
795	Glyndon loam, saline
852	Hamar loamy fine sand
883	Hamerly-Tonka-Parnell complex, 0 to 3 percent slopes
939	Hecla-Hamar loamy fine sands, 0 to 3 percent slopes
1030	Kranzburg-Lismore silty clay loams, 2 to 6 percent slopes
1043	La Prairie loam
1055	LaDelle silt loam
1081	Lamoure silt loam
1168	Lismore-Kranzburg silty clay loams, 0 to 2 percent slopes
1205	Maddock loamy fine sand, 6 to 15 percent slopes
1221	Maddock-Hecla loamy fine sands, 1 to 6 percent slopes
1269	Marysland silt loam
1403	Overly silty clay loam
1427	Parnell silty clay loam
1466	Pits, gravel and sand
1472	Rauville silty clay loam
1523	Renshaw loam, 0 to 3 percent slopes
1560	Rifle mucky peat
1577	Rosewood fine sandy loam
1648	Serden-Dune land complex, 1 to 35 percent slopes
1670	Ulen-Rosewood fine sandy loams
1704	Sioux-Renshaw complex, 0 to 6 percent slopes
1709	Southam silt loam
1772	Svea-Gardena loams
1788	Swenoda-Barnes complex, 0 to 6 percent slopes
1834	Tonka silt loam
1842	Towner loamy fine sand, 0 to 3 percent slopes
1859	Ulen fine sandy loam
1871	Vallers loam, saline
1883	Vallers-Parnell complex
1935	Venlo fine sandy loam
1953	Wahpeton silty clay
1978	Water
2049	Wyndmere loam
2091	Zell loam, 9 to 25 percent slopes
2206	Barnes-Sioux complex, 3 to 9 percent slopes
2207	Bearden silt loam
2208	Brantford-Coe loams, 1 to 6 percent slopes
2209	Buse-Barnes loams, 15 to 50 percent slopes
2210	Cathay-Larson loams, bouldery
2211	Eckman-Gardena loams, 3 to 6 percent slopes
2212	Eckman-Zell loams, 3 to 6 percent slopes
2213	Eckman-Zell loams, 6 to 9 percent slopes
2214	Exline loam
2215	Fairdale loam, 0 to 6 percent slopes
2216	Gwinner-Peever-Parnell complex, 0 to 3 percent slopes
2217	Hamerly-Buse-Parnell complex, 0 to 6 percent slopes
2218	Brantford-Vang loams, 1 to 3 percent slopes
2219	Hegne silty clay loam
2220	Letcher-Lemert sandy loams
2221	Falsen loamy sand, 0 to 3 percent slopes
2222	Peever-Gwinner complex, 3 to 6 percent slopes
2223	Renshaw-Sioux complex, 0 to 6 percent slopes
2224	Serden-Hamar complex, 0 to 15 percent slopes
2225	Sioux cobbly sandy loam, 6 to 15 percent slopes
2226	Stirum-Lemert sandy loams
2228	Aymer-Rosewood-Serden complex, 0 to 9 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state, or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline and neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool lagoon — FLOOD POOL LINE

STATE COORDINATE TICK 1 890 000 FEET

LAND DIVISION CORNER (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 173
- Federal — 287
- State — 52
- County, farm or ranch — 386

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small (Named where applicable) — 1978

PITS

- Gravel pit 1 to 5 acres
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban area) (occupied)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — 1978
- Intermittent

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 1168 1030

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

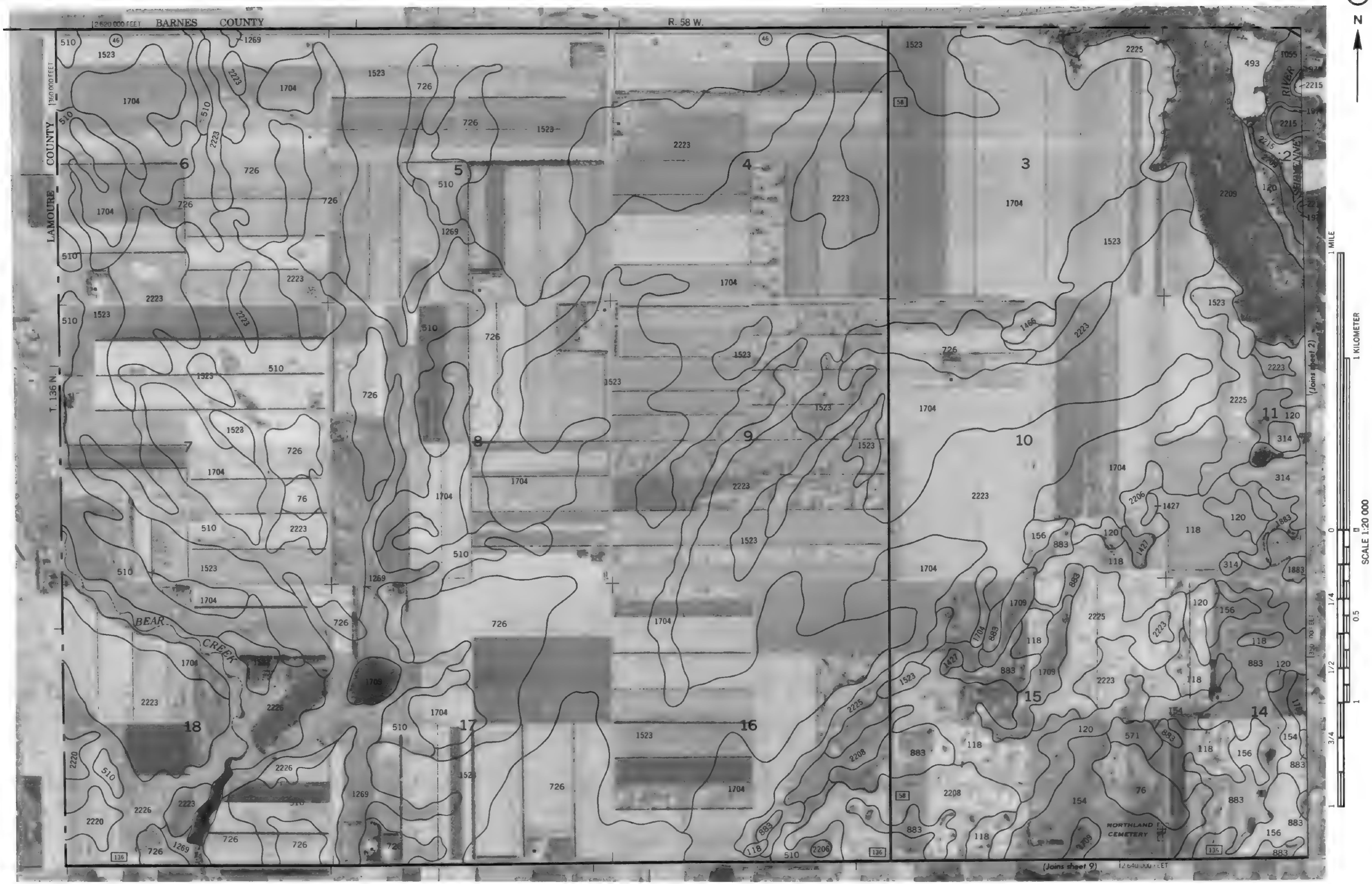
GULLY

DEPRESSION OR SINK

SOIL SAMPLE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RANSOM COUNTY, NORTH DAKOTA NO. 1

RANSOM COUNTY, NORTH DAKOTA NO. 2

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3

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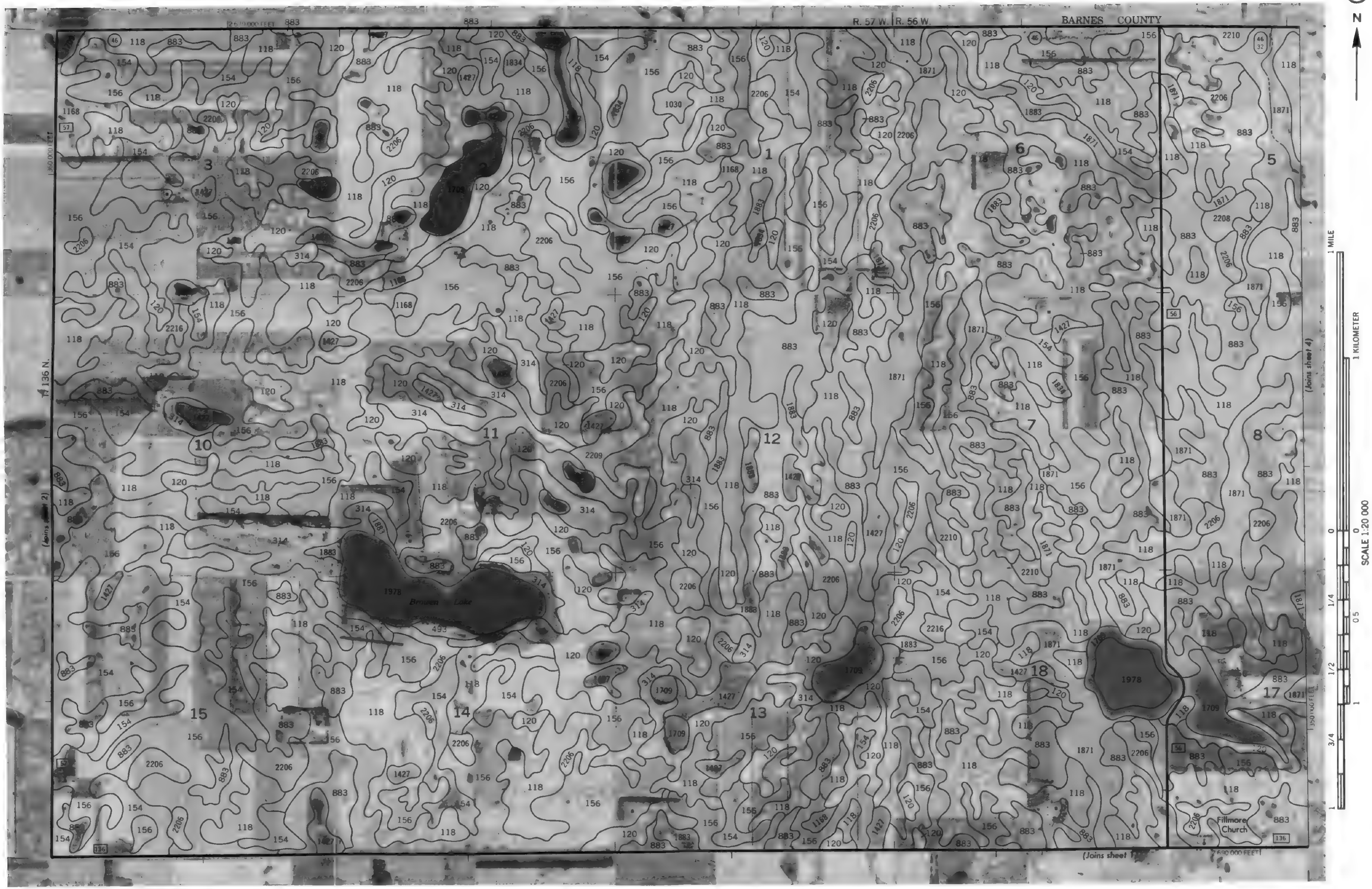
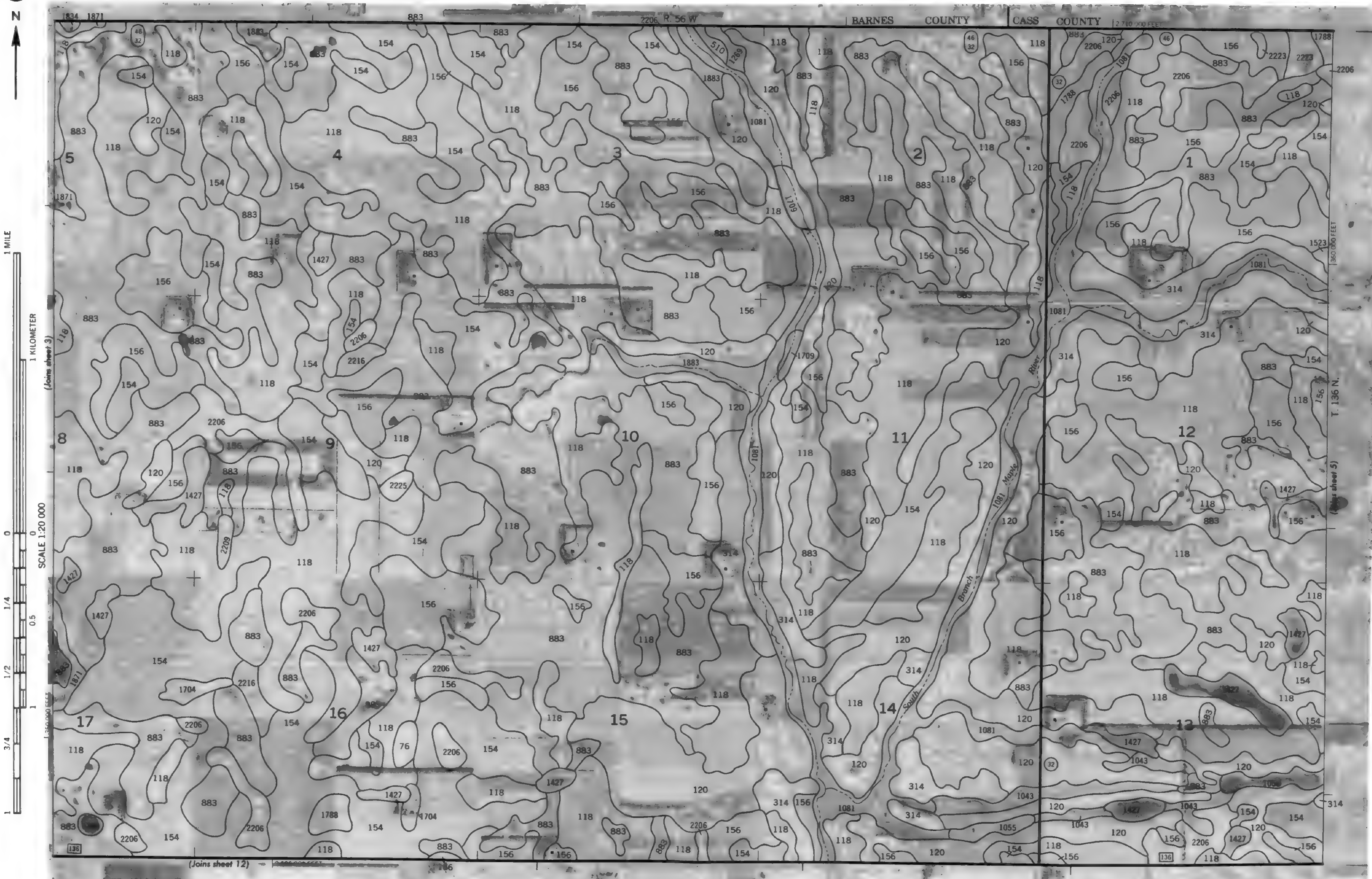
RANSOM COUNTY, NORTH DAKOTA NO. 3





RANSOM COUNTY, NORTH DAKOTA NO. 4

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

5

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RANSOM COUNTY, NORTH DAKOTA NO. 5

6

SOIL SURVEY OF RANSOM COUNTY, NORTH DAKOTA — SHEET NUMBER 6

RANSOM COUNTY, NORTH DAKOTA NO. 6

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7

N

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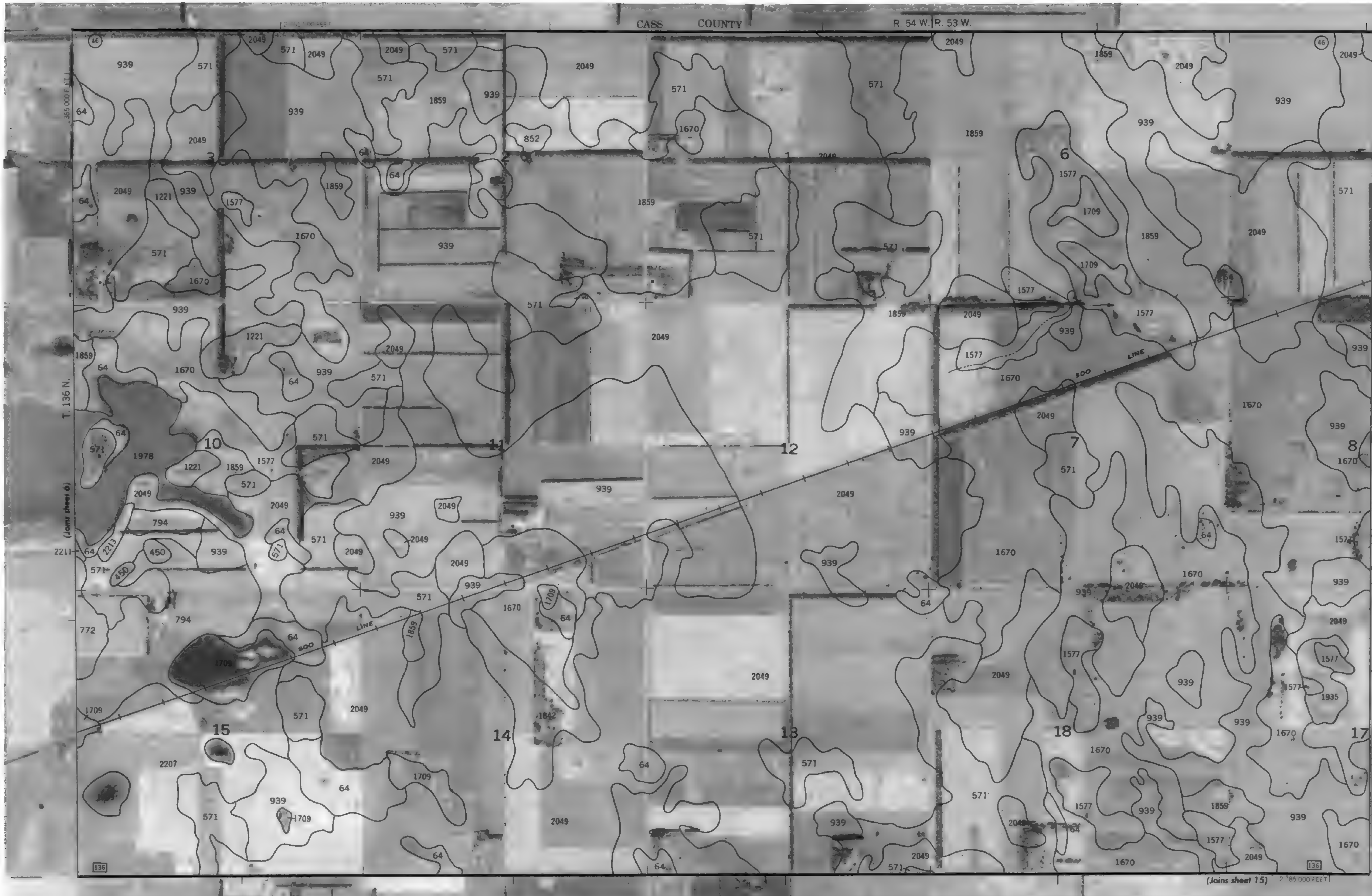
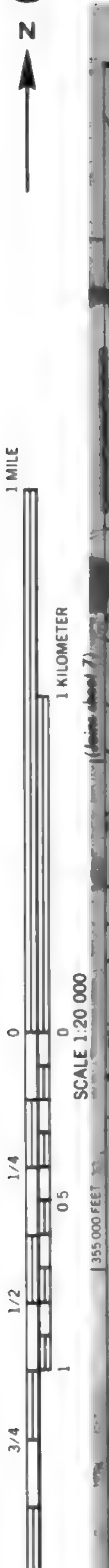
RANSOM COUNTY, NORTH DAKOTA NO. 7



1 MILE
1 KILOMETER
SCALE 1:20 000
0
1/4
1/2
3/4
1
0.5

SOIL SURVEY OF RANSOM COUNTY, NORTH DAKOTA — SHEET NUMBER 8



RANSOM COUNTY, NORTH DAKOTA NO. 8

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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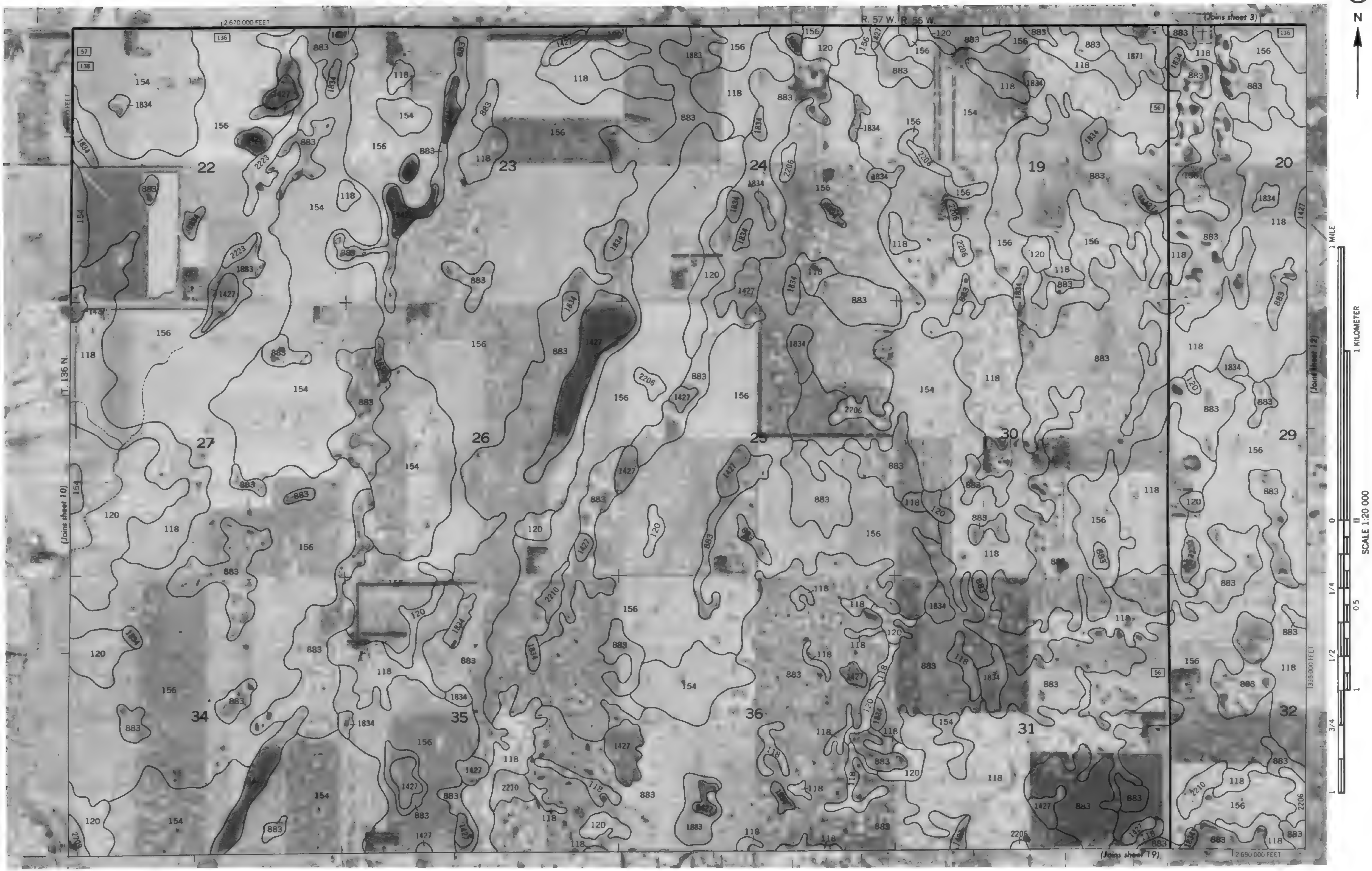
RANSOM COUNTY, NORTH DAKOTA NO. 9

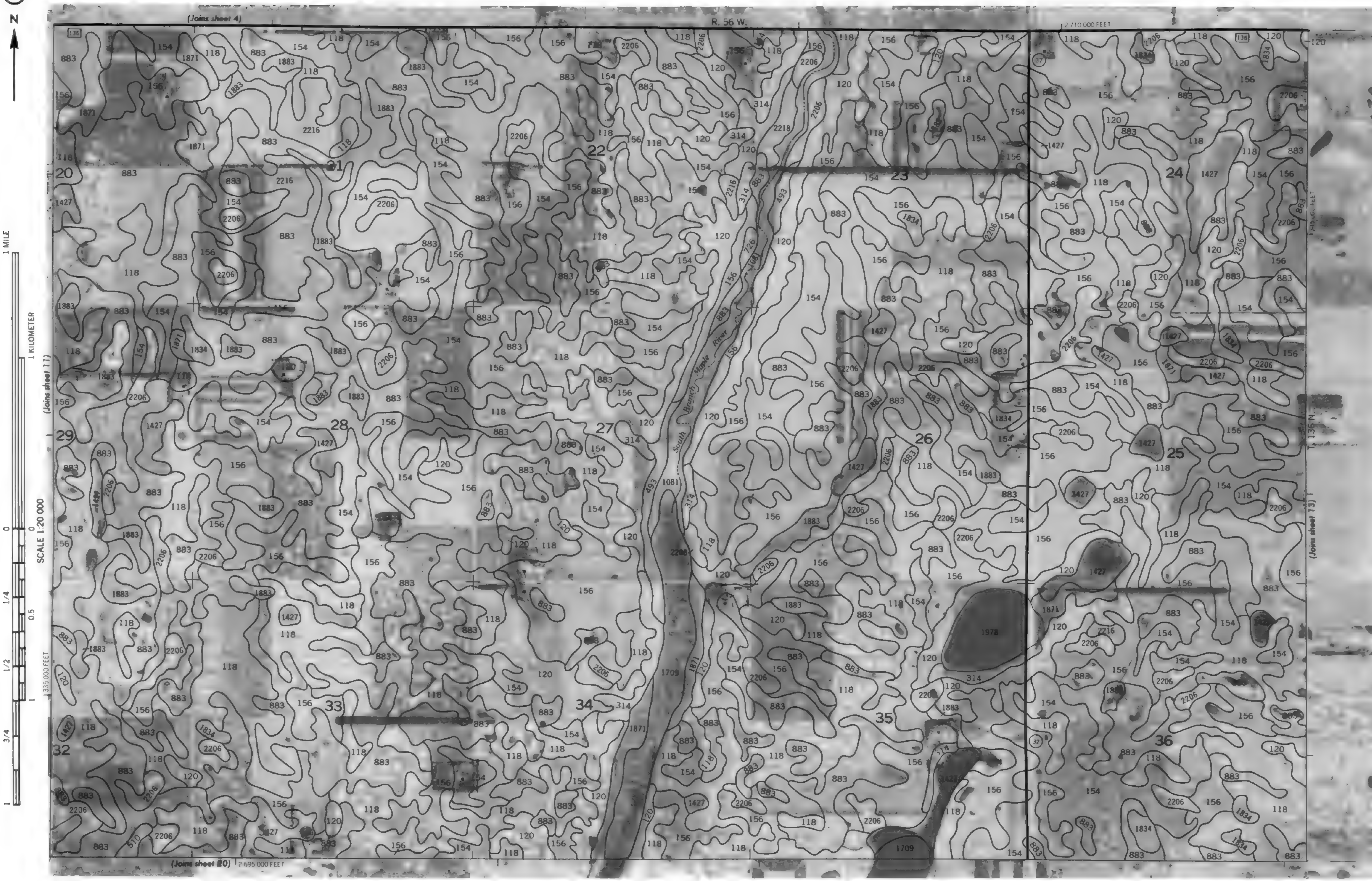
RANSOM COUNTY, NORTH DAKOTA NO. 10

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RANSOM COUNTY, NORTH DAKOTA NO. 11



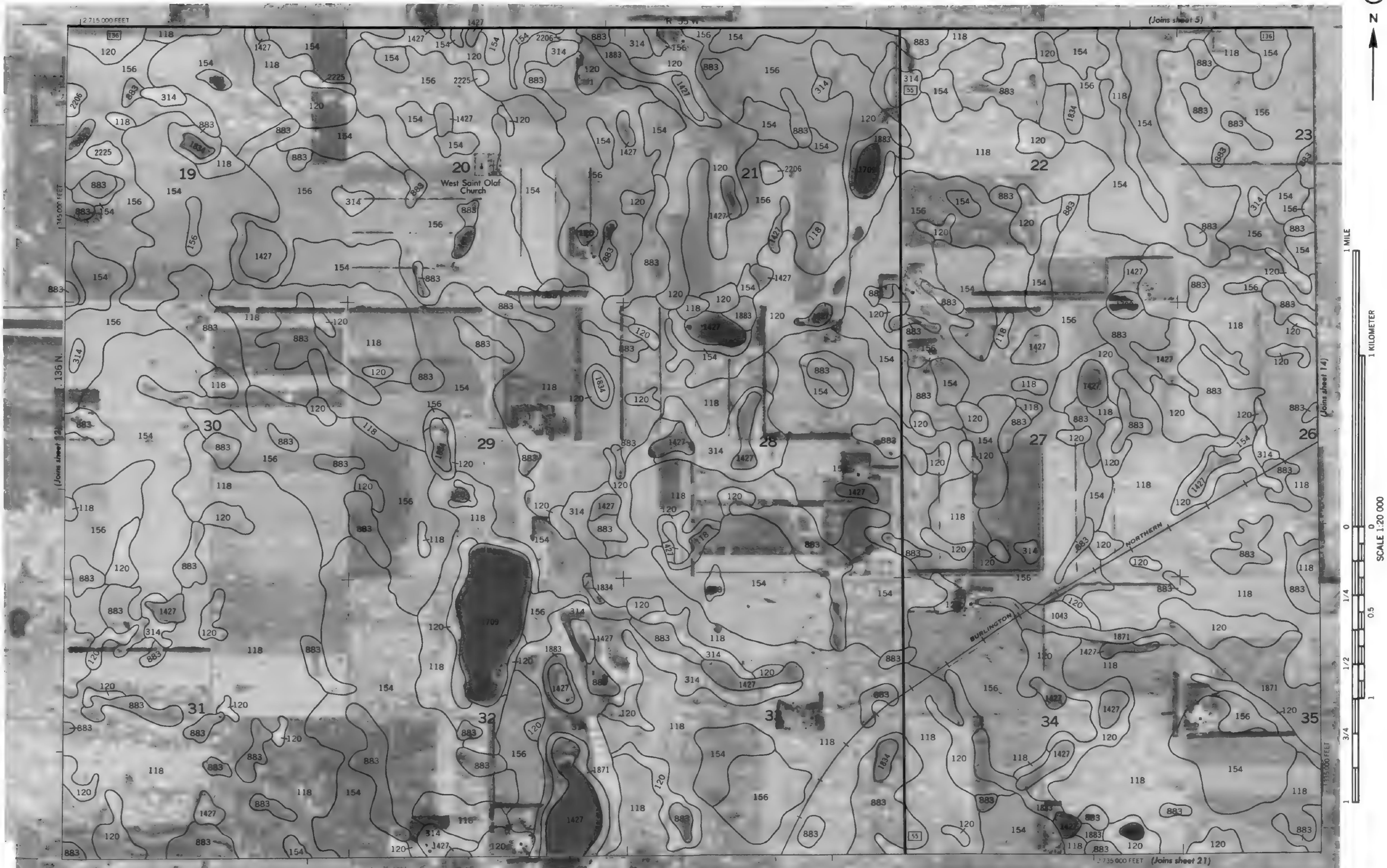
RANSOM COUNTY, NORTH DAKOTA NO. 12

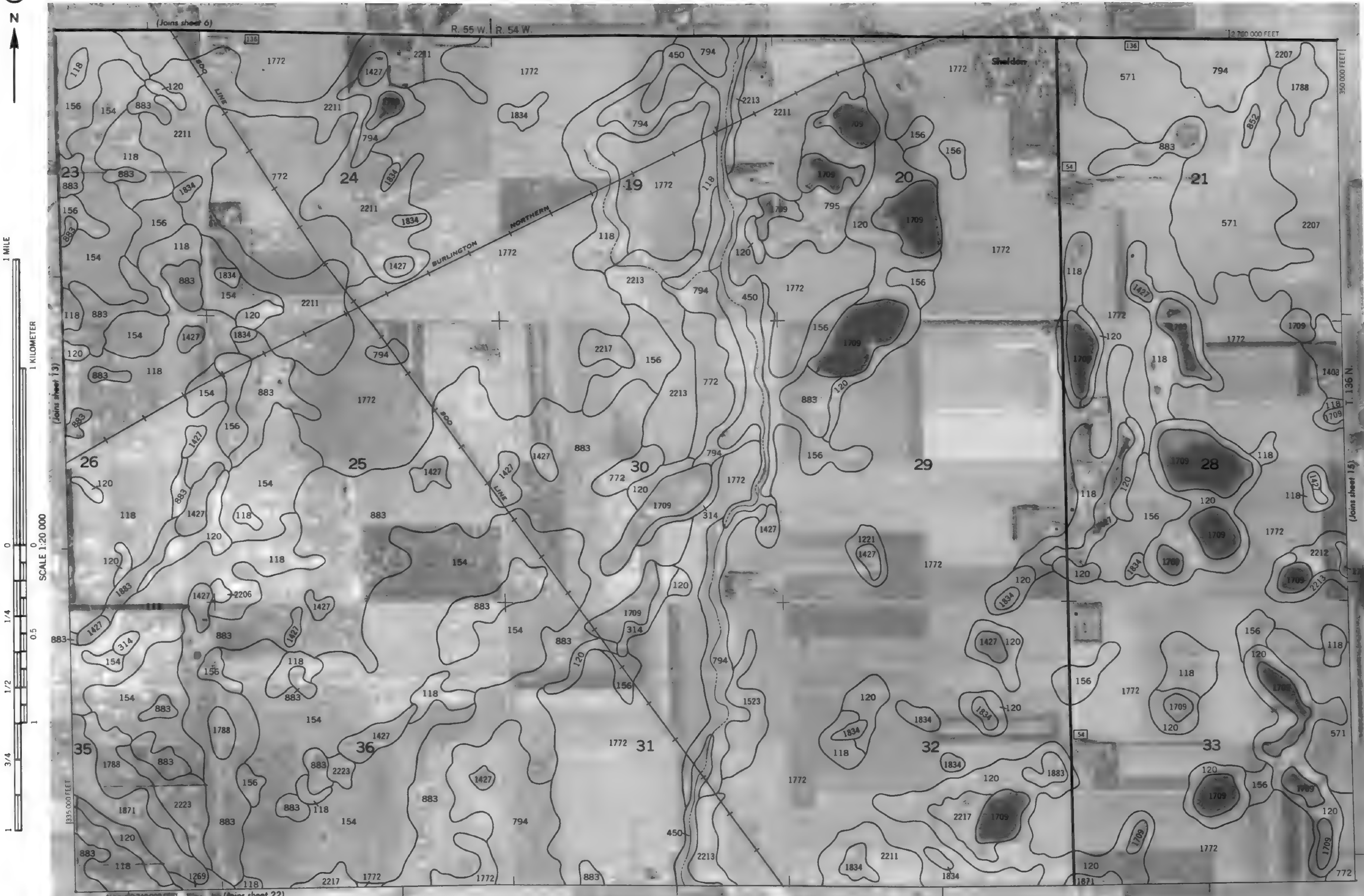
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

13

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RANSOM COUNTY, NORTH DAKOTA NO. 13





RANSOM COUNTY, NORTH DAKOTA NO. 14

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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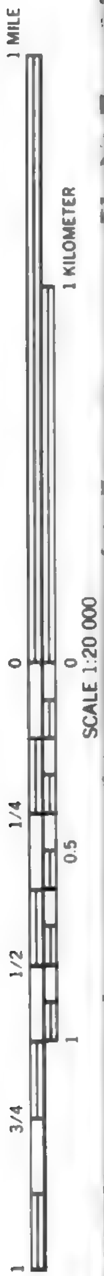
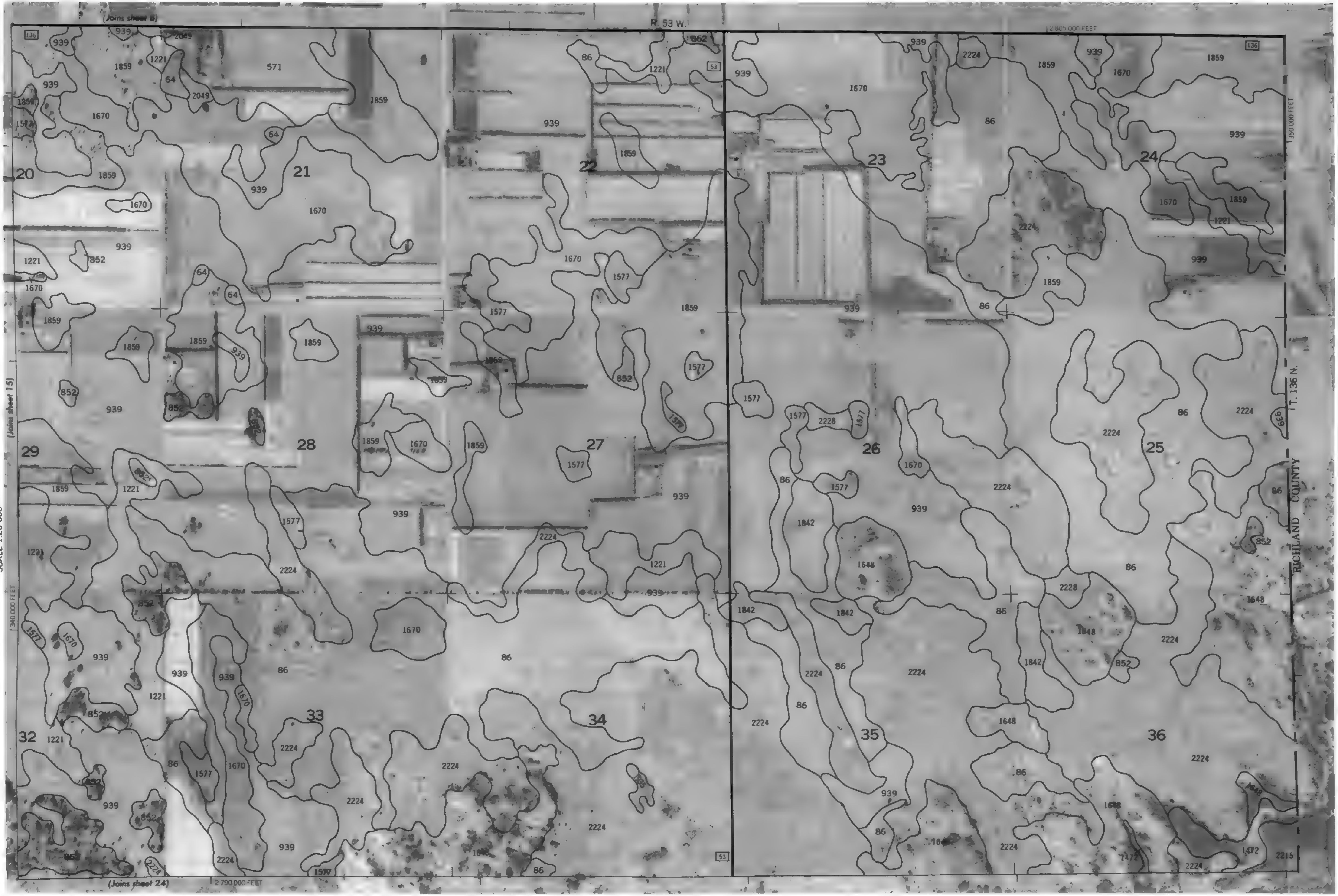
RANSOM COUNTY, NORTH DAKOTA NO. 15

SOIL SURVEY OF RANSOM COUNTY, NORTH DAKOTA — SHEET NUMBER 16

N





RANSOM COUNTY, NORTH DAKOTA NO. 16

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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RANSOM COUNTY, NORTH DAKOTA NO. 17

SOIL SURVEY OF RANSOM COUNTY, NORTH DAKOTA — SHEET NUMBER 18

RANSOM COUNTY, NORTH DAKOTA NO. 18

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

19

N

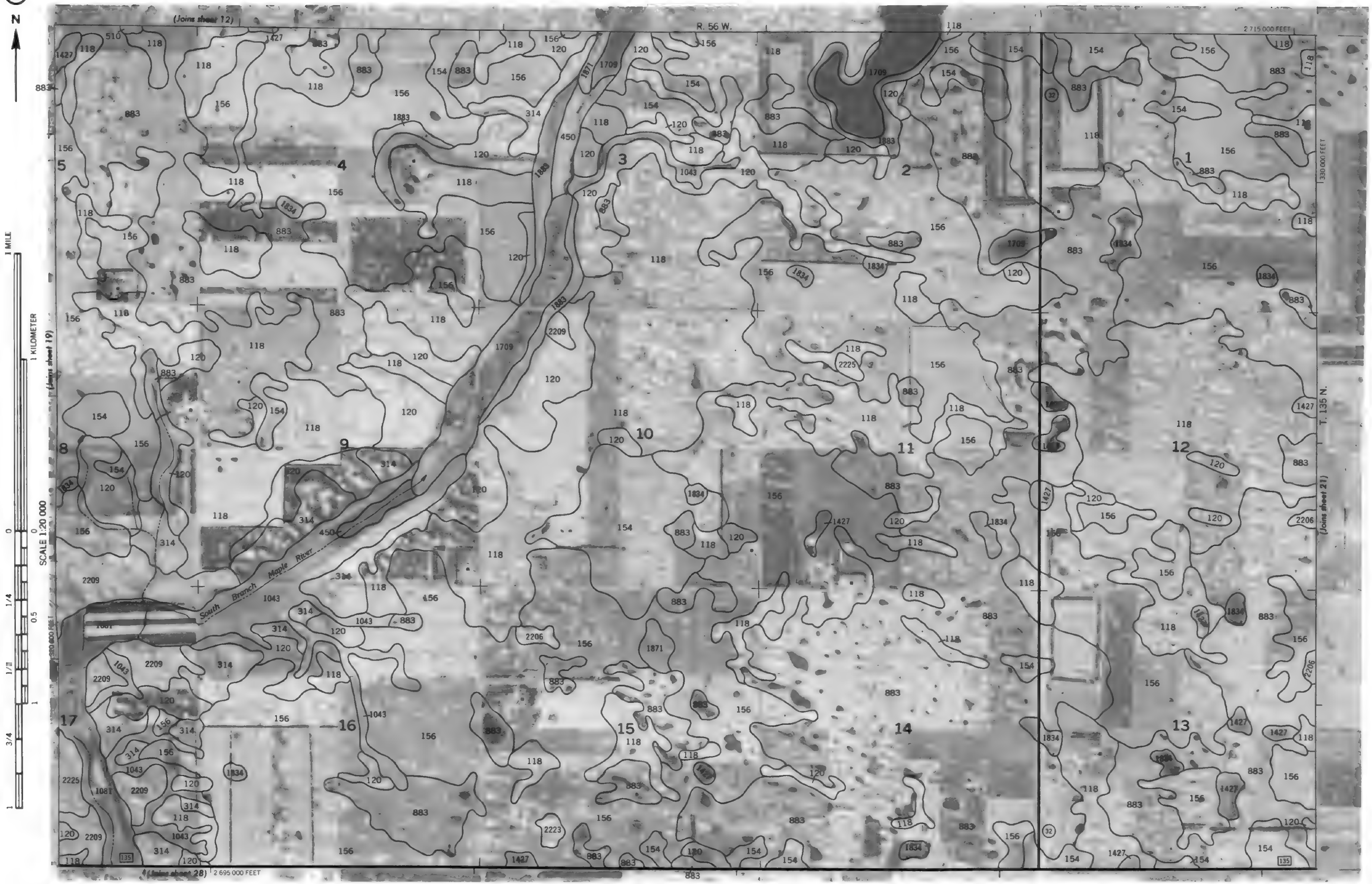
1 MILE

1 KILOMETER

SCALE 1:20 000

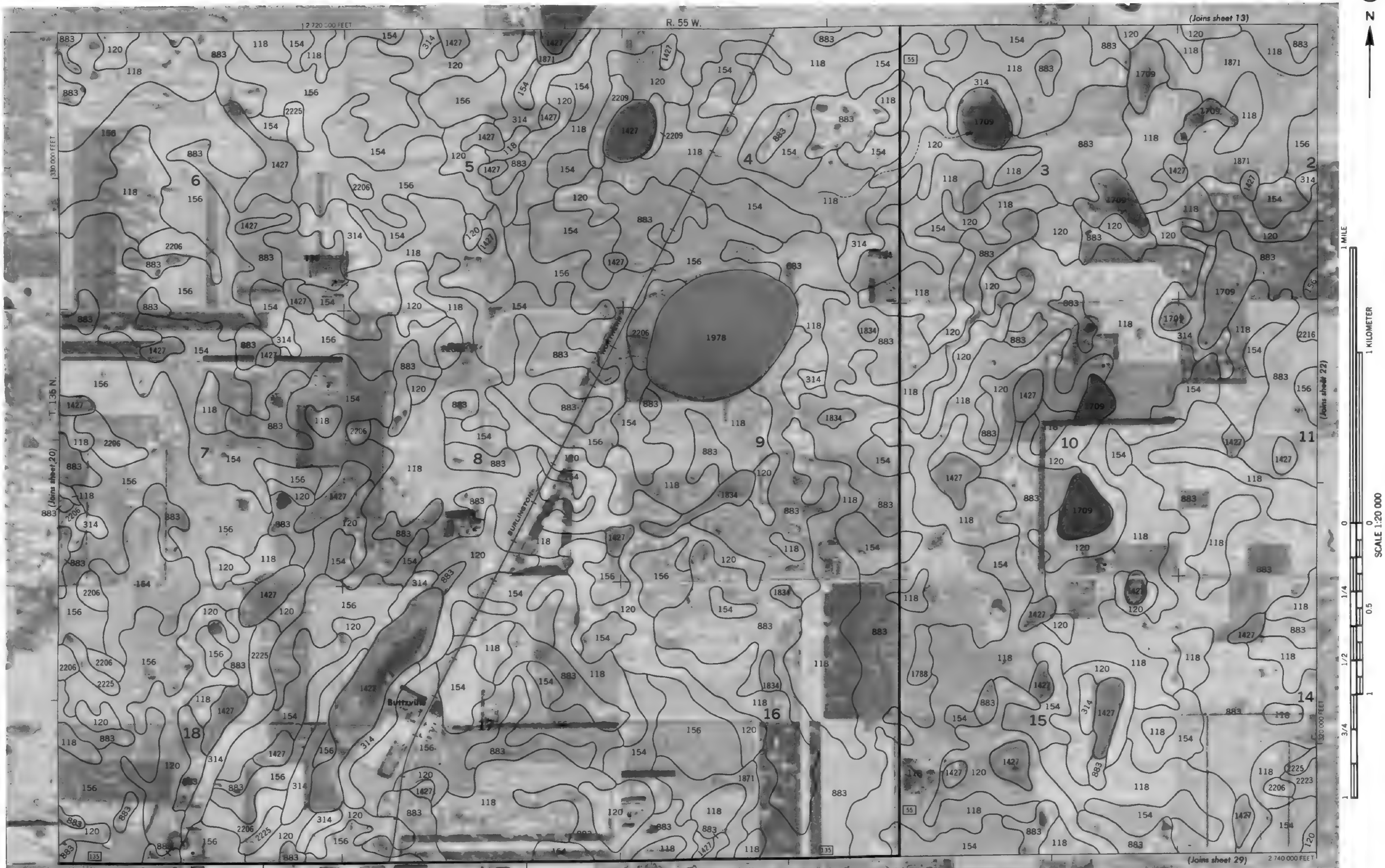
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RANSOM COUNTY, NORTH DAKOTA NO. 19



RANSOM COUNTY, NORTH DAKOTA NO. 20

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RANSOM COUNTY, NORTH DAKOTA NO. 21

SOIL SURVEY OF RANSOM COUNTY, NORTH DAKOTA — SHEET NUMBER 22

RANSOM COUNTY, NORTH DAKOTA NO. 22

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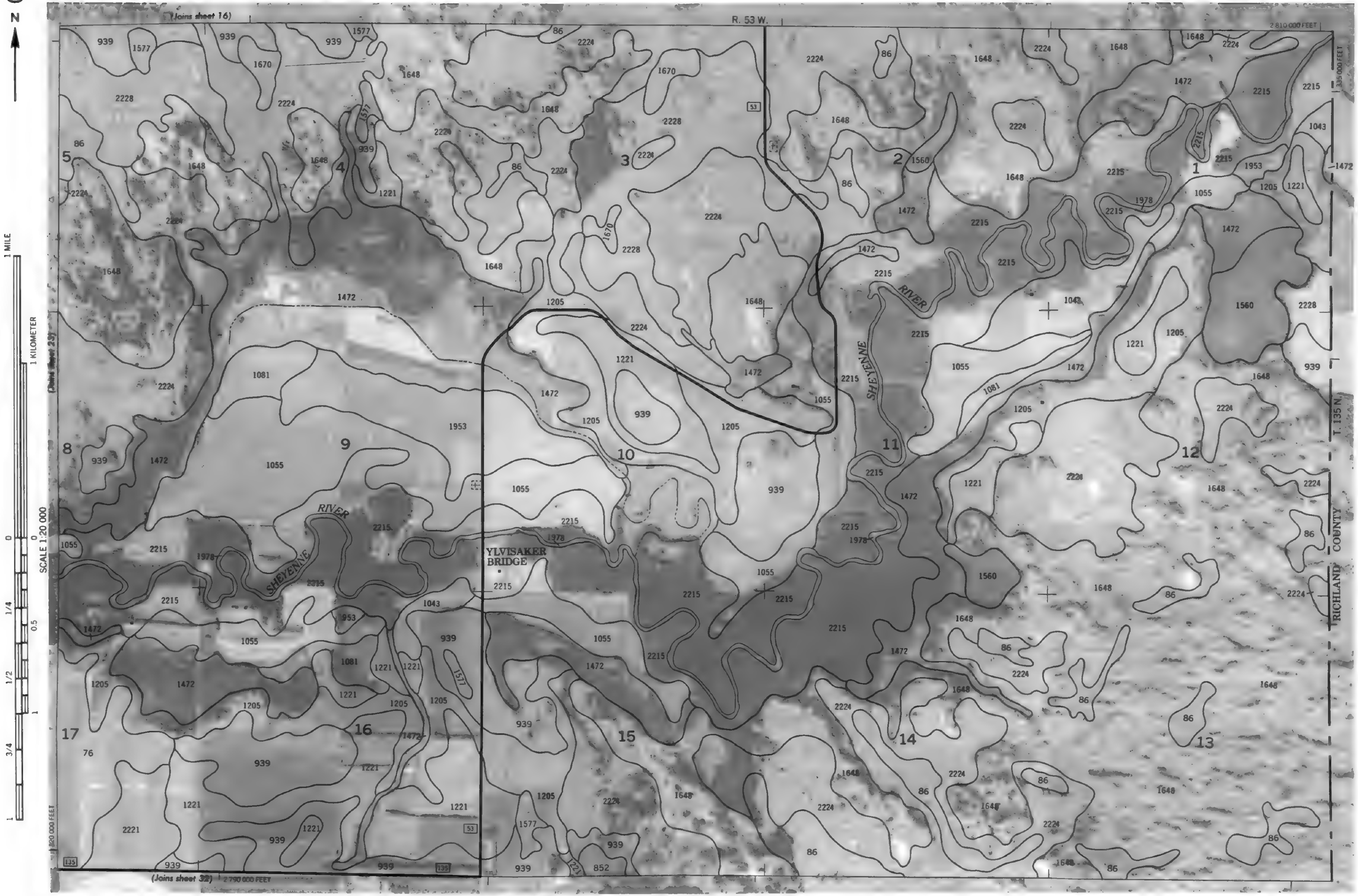
RANSOM COUNTY, NORTH DAKOTA NO. 23

SOIL SURVEY OF RANSOM COUNTY, NORTH DAKOTA — SHEET NUMBER 24



RANSOM COUNTY, NORTH DAKOTA NO. 24

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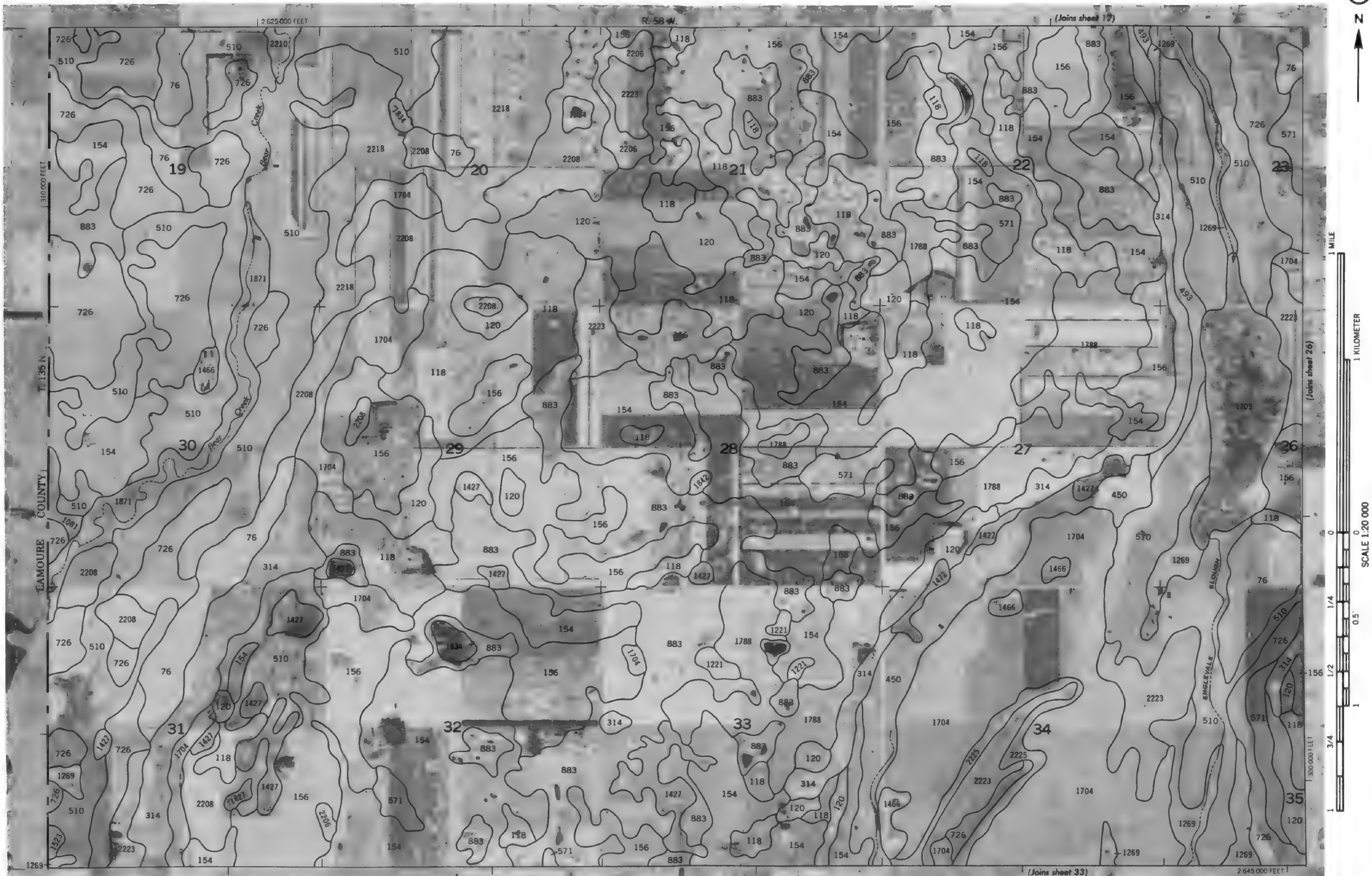
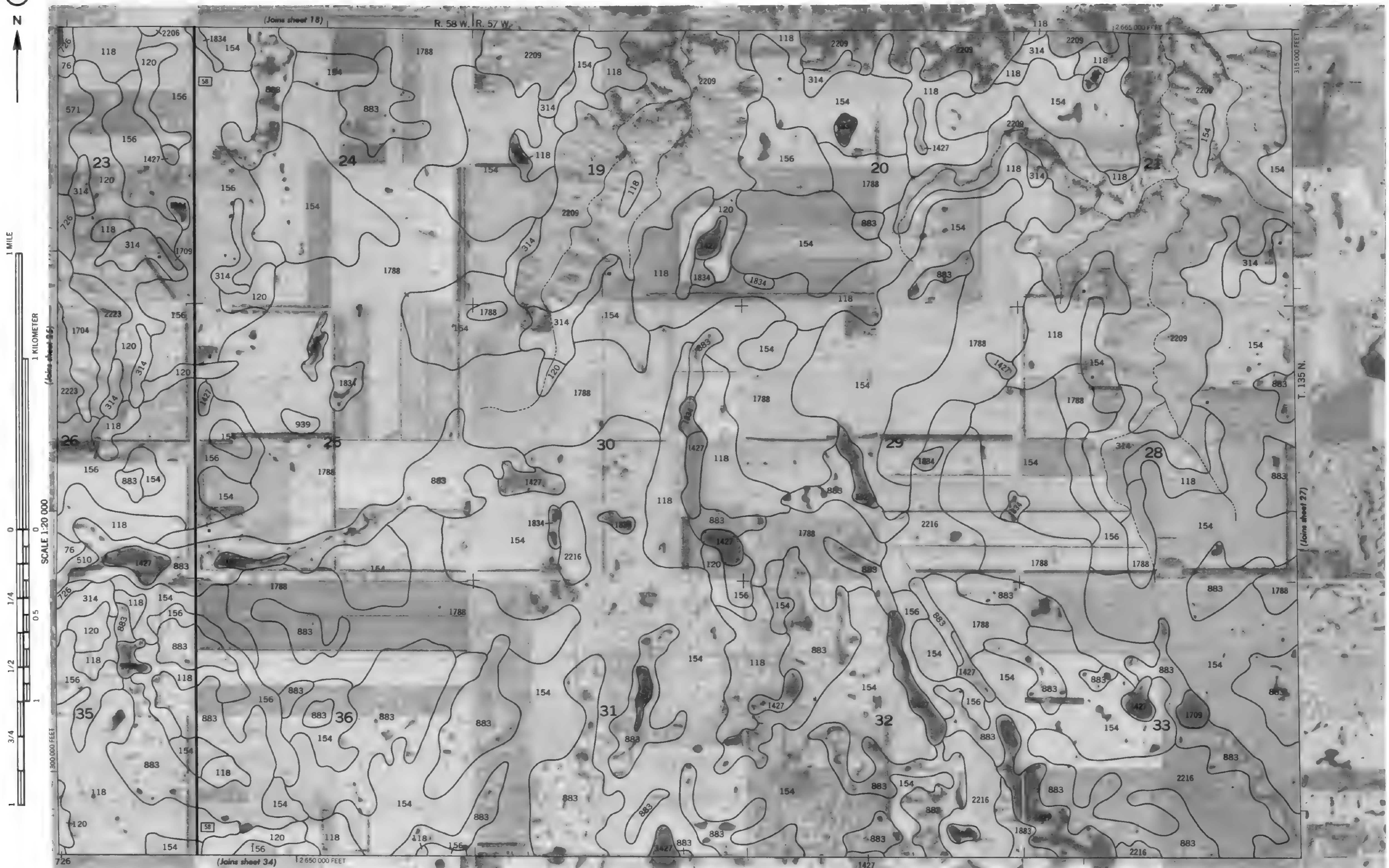
RANSOM COUNTY, NORTH DAKOTA NO. 25



SOIL SURVEY OF RANSOM COUNTY, NORTH DAKOTA — SHEET NUMBER 26



RANSOM COUNTY, NORTH DAKOTA NO. 26

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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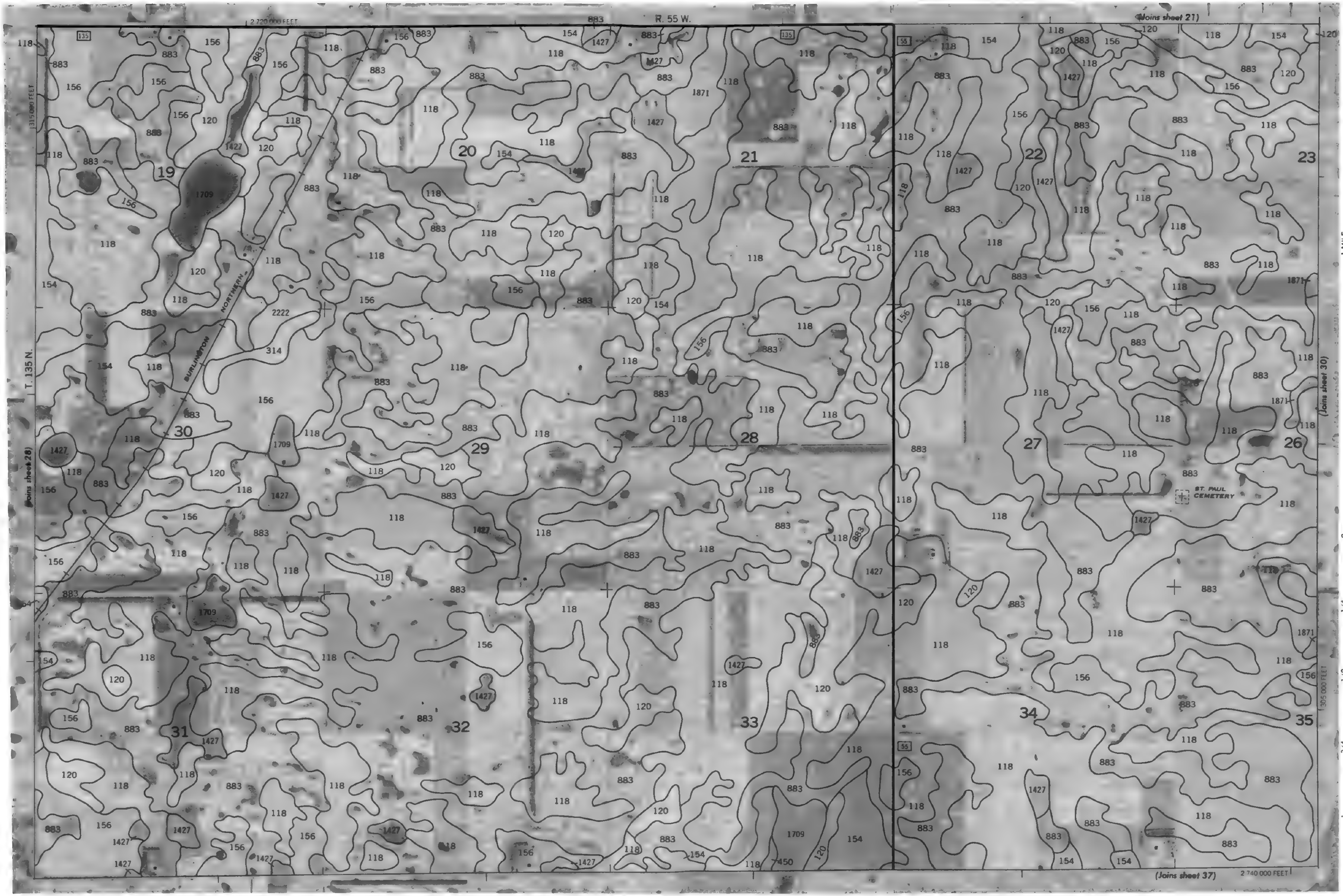
RANSOM COUNTY, NORTH DAKOTA NO. 28

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

29



N

SCALE 1:20 000

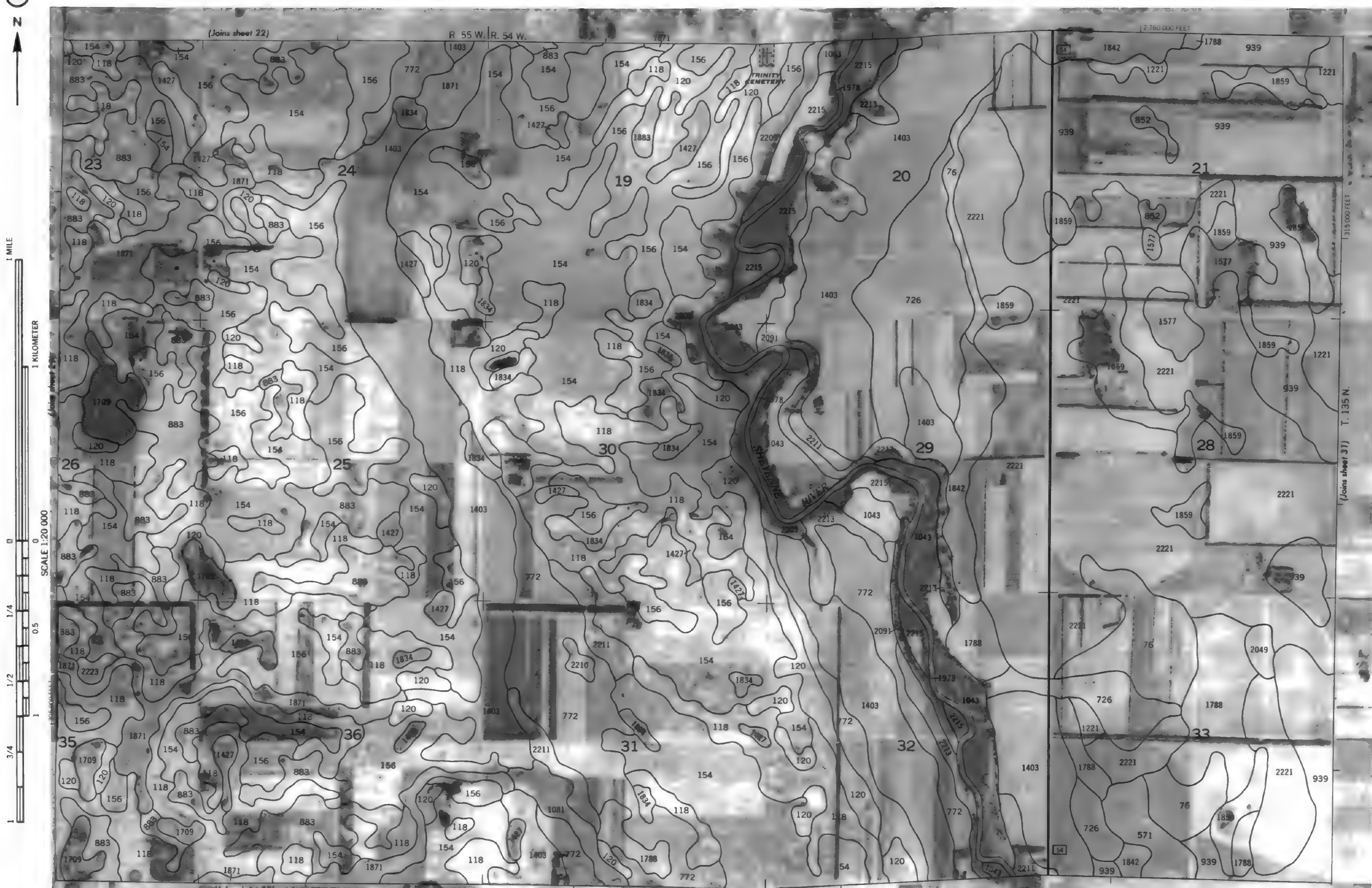
1 MILE

1 KILOMETER

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

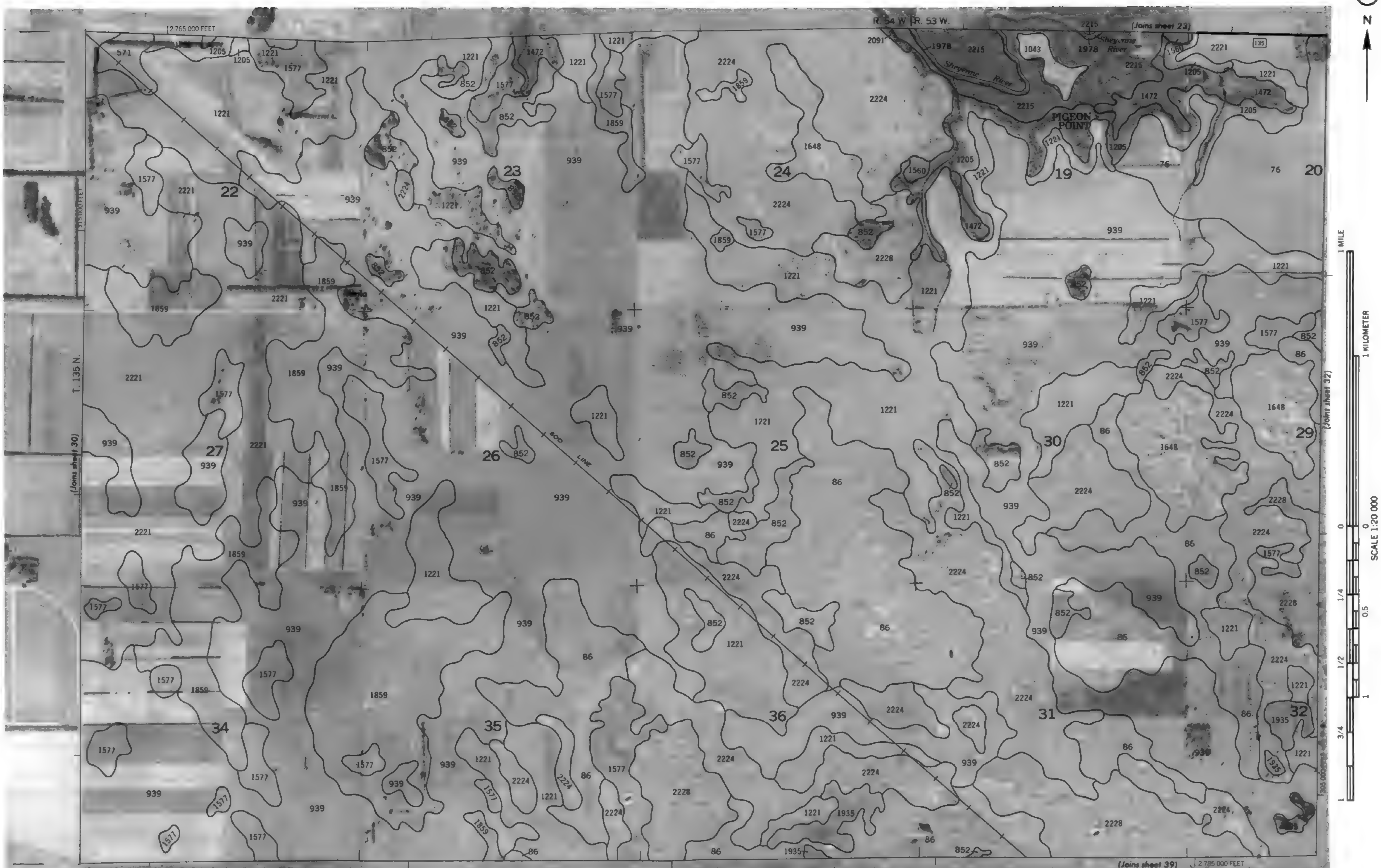
RANSOM COUNTY, NORTH DAKOTA NO. 29

SOIL SURVEY OF RANSOM COUNTY, NORTH DAKOTA — SHEET NUMBER 30



RANSOM COUNTY, NORTH DAKOTA NO. 30

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



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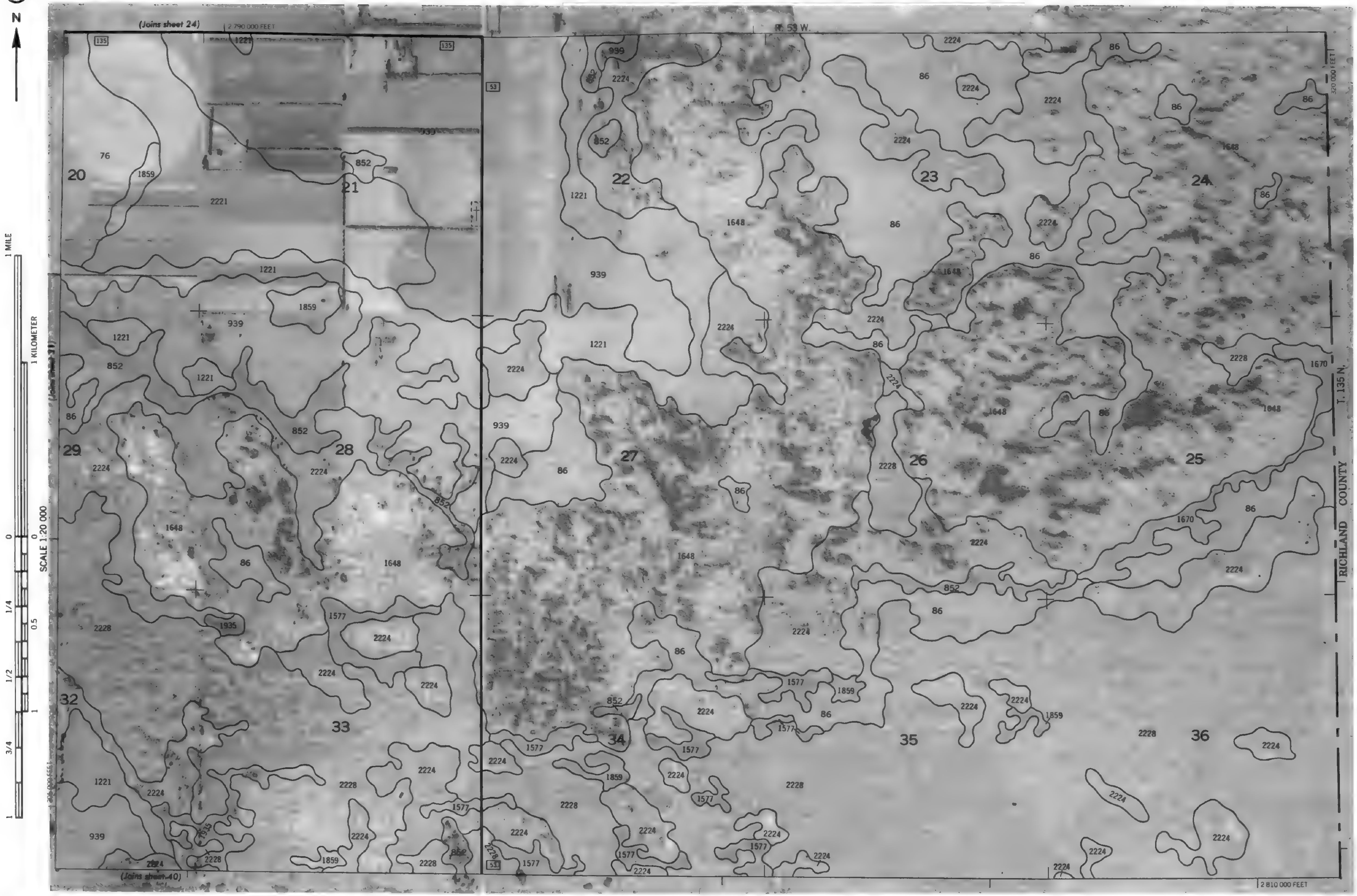
RANSOM COUNTY, NORTH DAKOTA NO. 31



RANSOM COUNTY, NORTH DAKOTA NO. 32

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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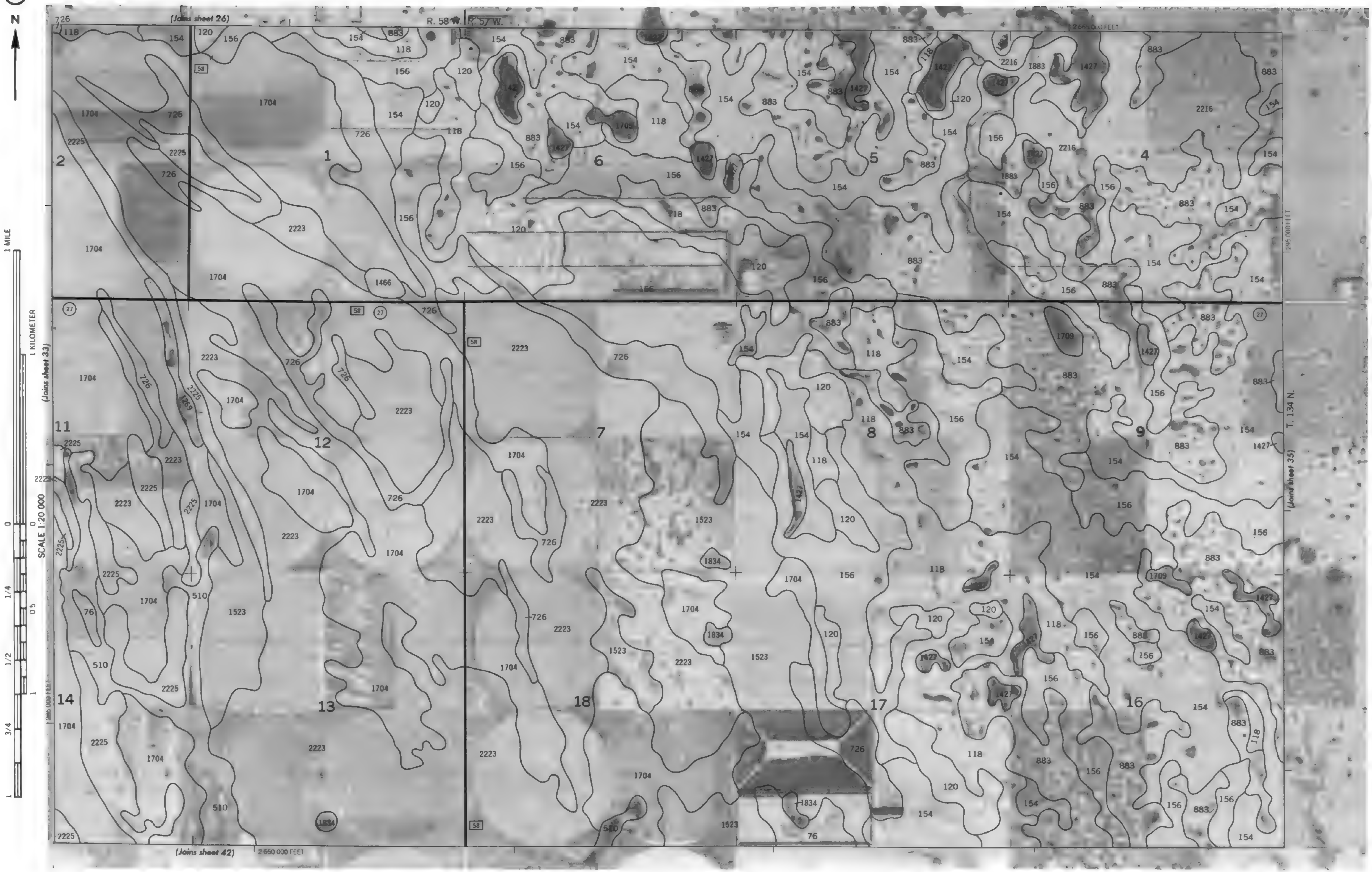
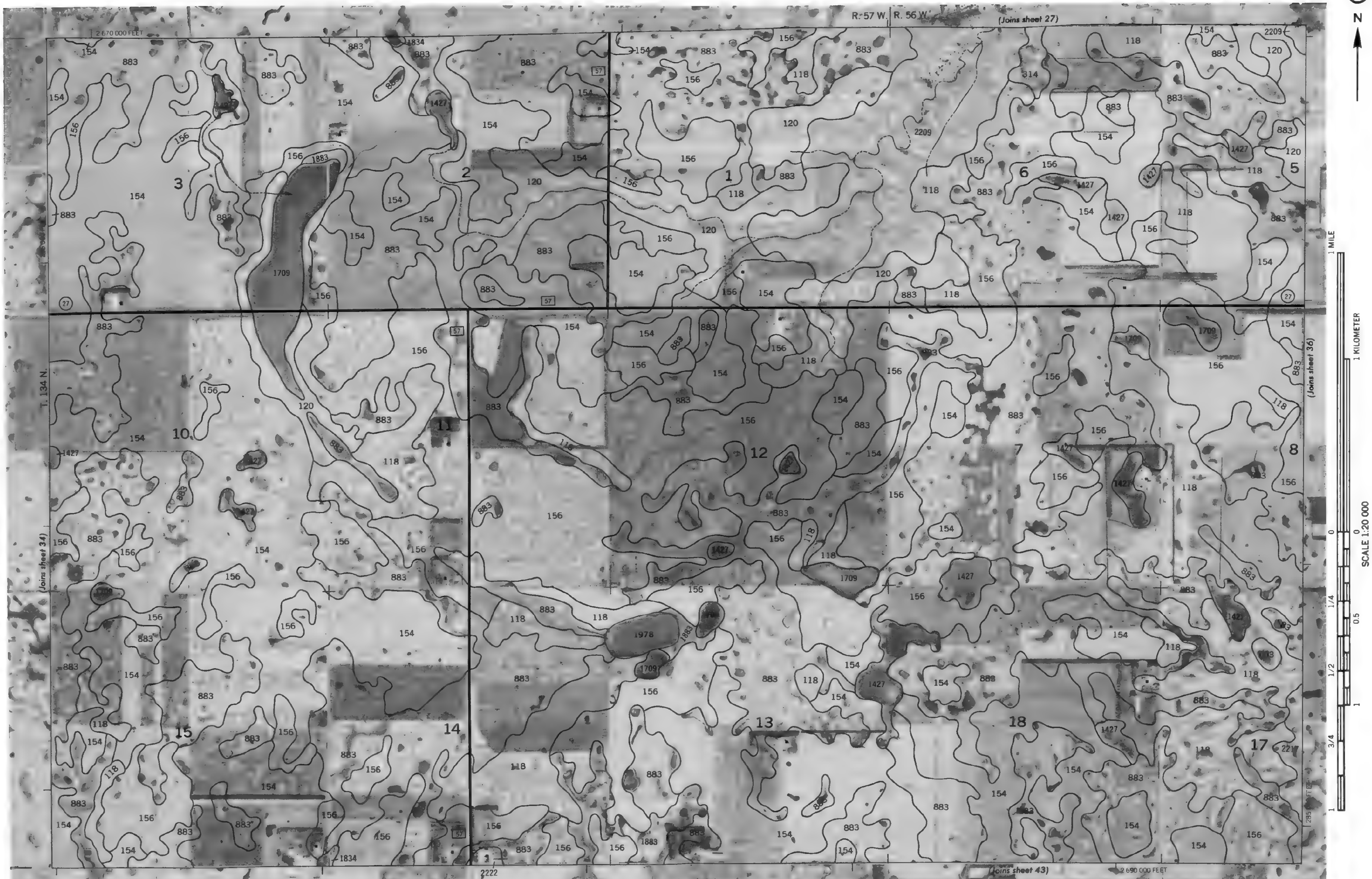


RANSOM COUNTY, NORTH DAKOTA NO. 34

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RANSOM COUNTY, NORTH DAKOTA NO. 35

SOIL SURVEY OF RANSOM COUNTY, NORTH DAKOTA — SHEET NUMBER 36

RANSOM COUNTY, NORTH DAKOTA NO. 36

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RANSOM COUNTY, NORTH DAKOTA NO. 37

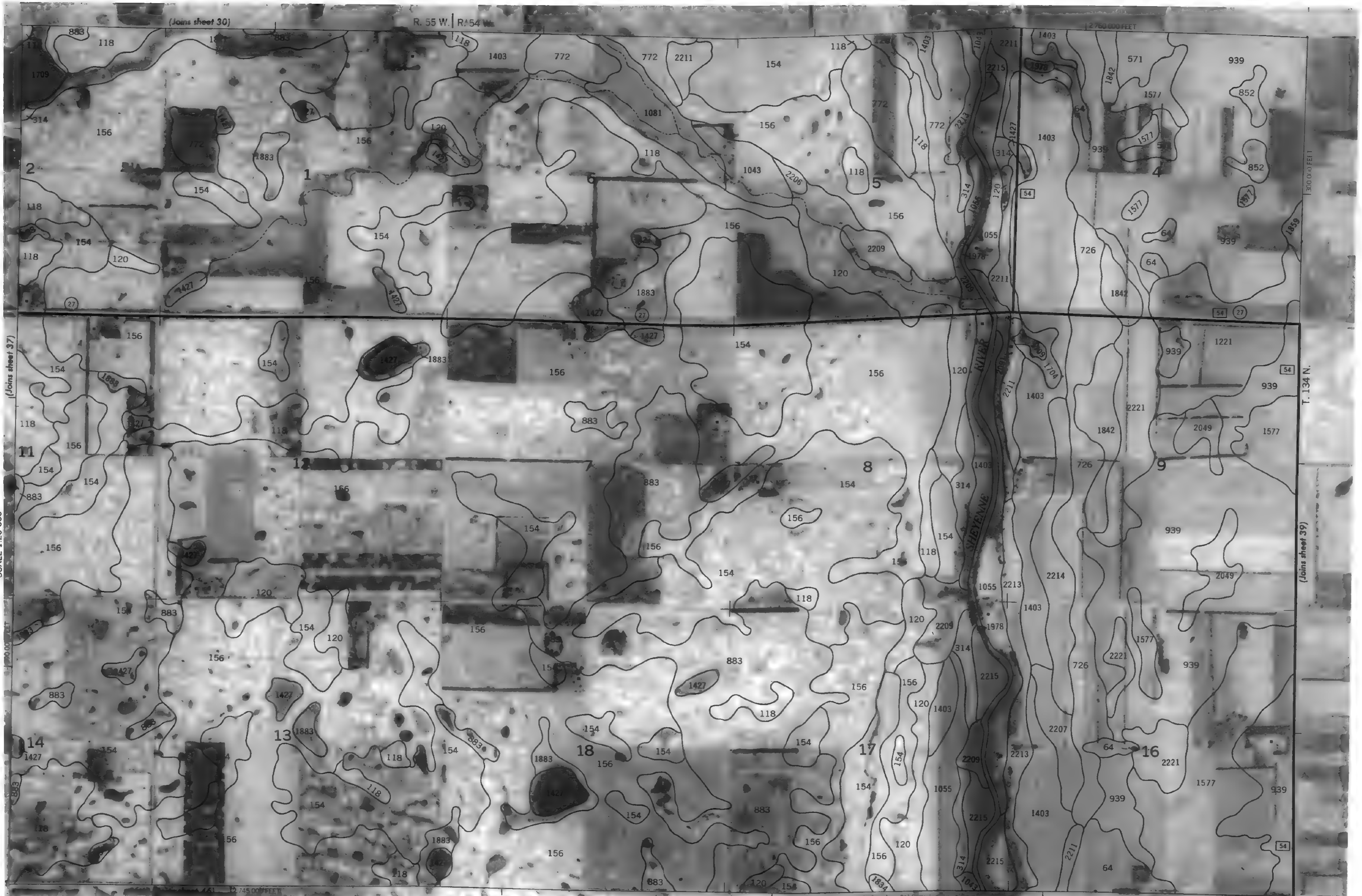
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

1 MILE

1 KILOMETER

SCALE 1:20 000



RANSOM COUNTY, NORTH DAKOTA NO. 38

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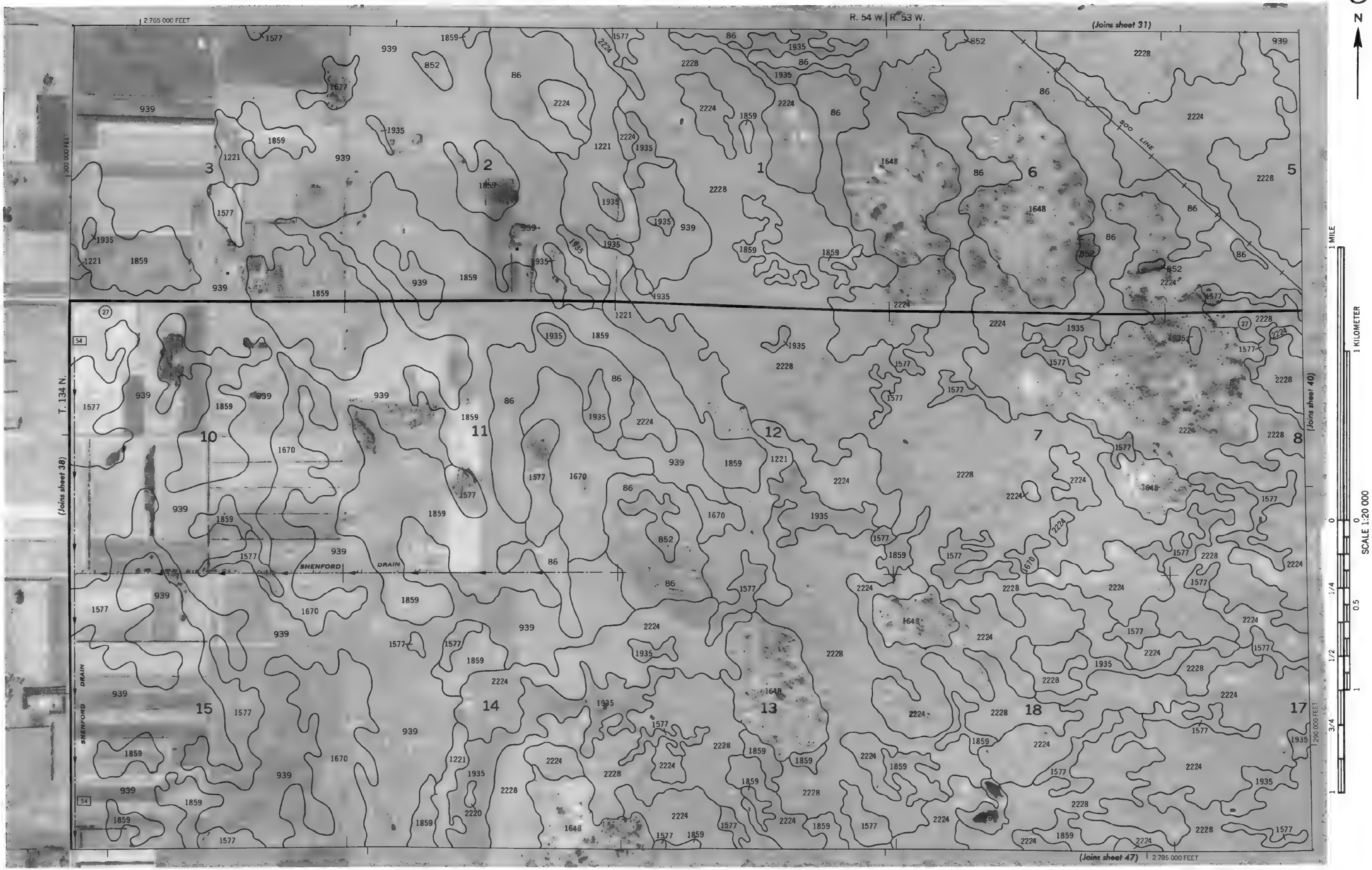
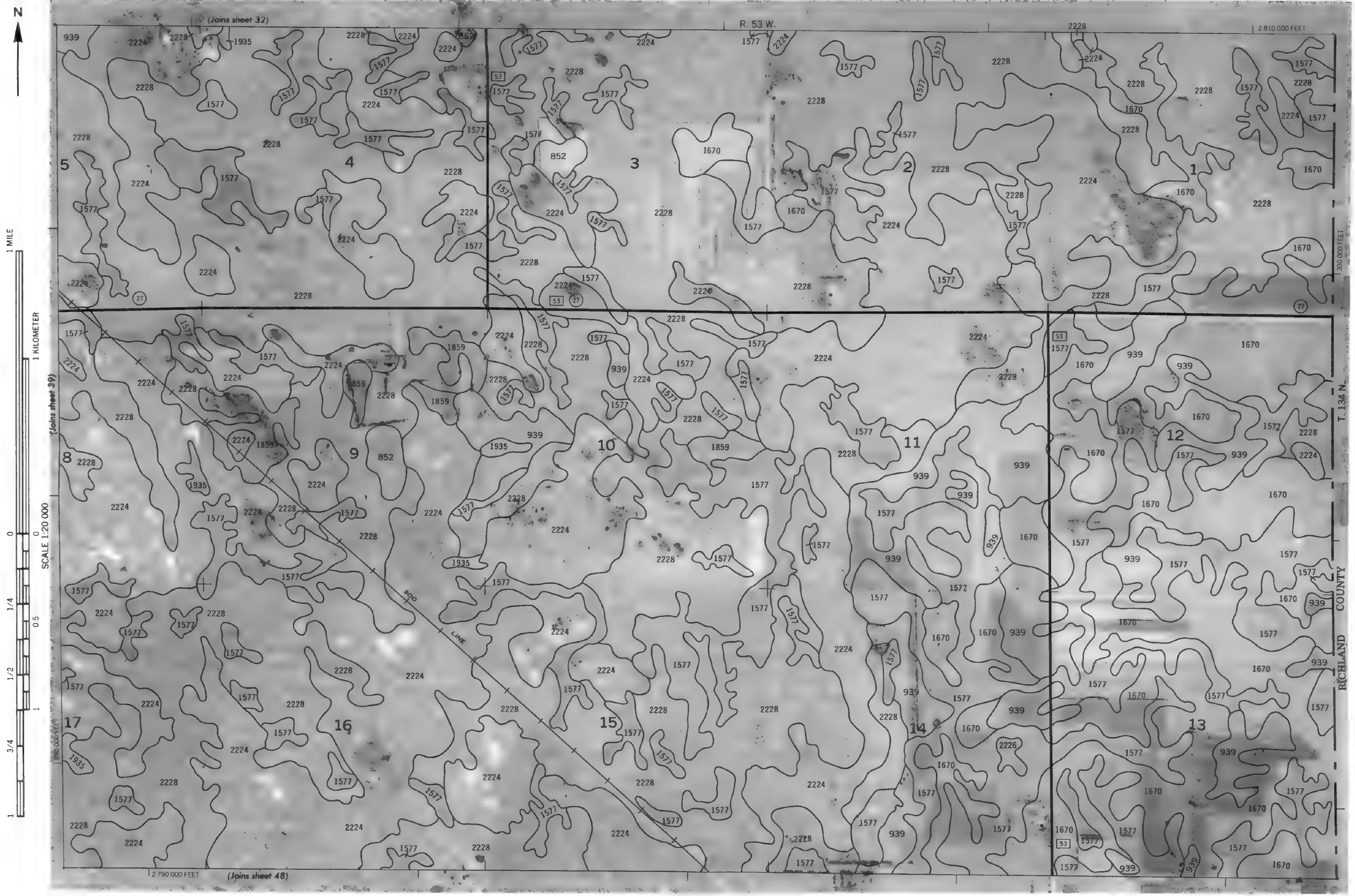
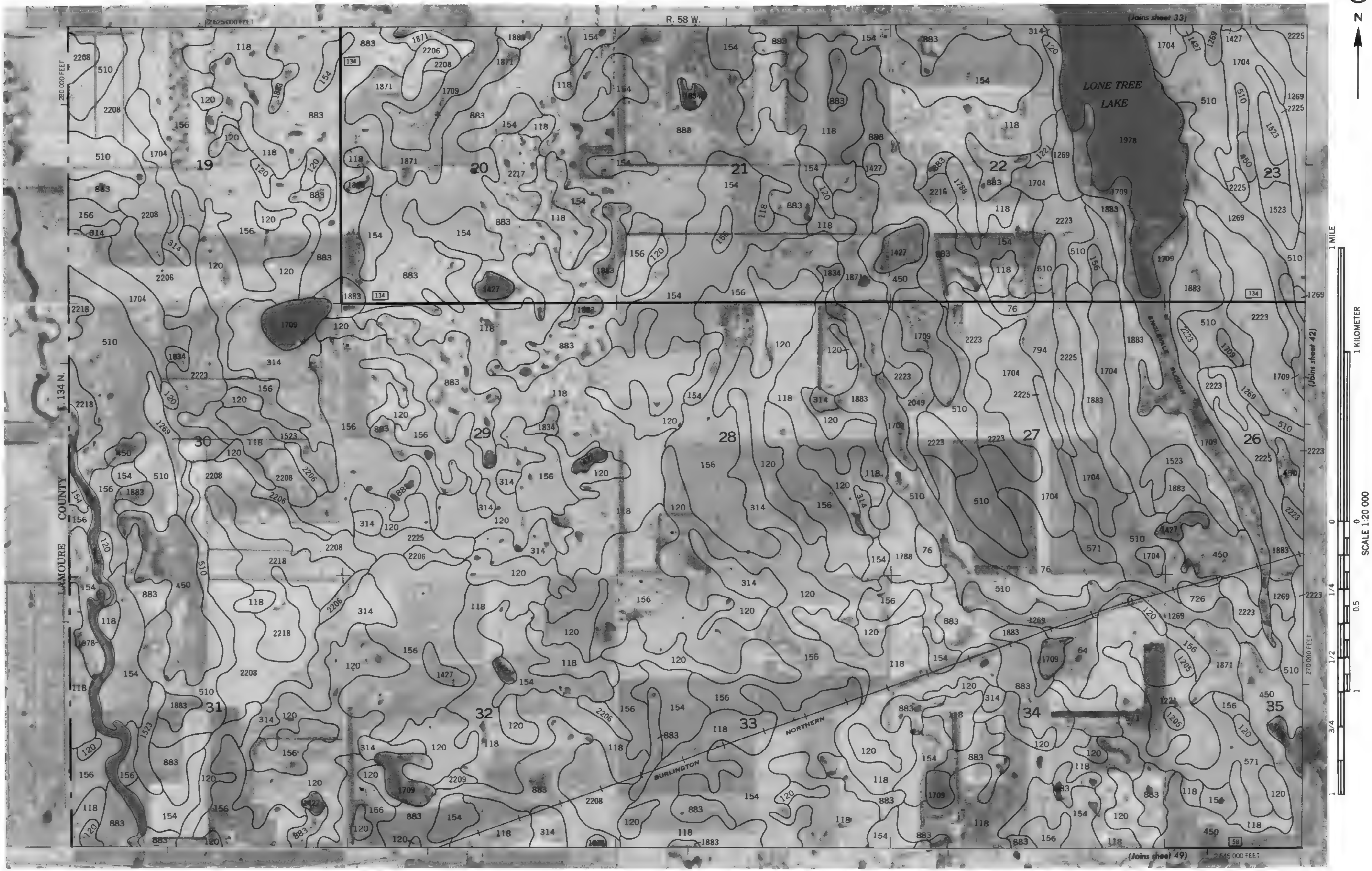
RANSOM COUNTY, NORTH DAKOTA NO. 39





RANSOM COUNTY, NORTH DAKOTA NO. 40

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



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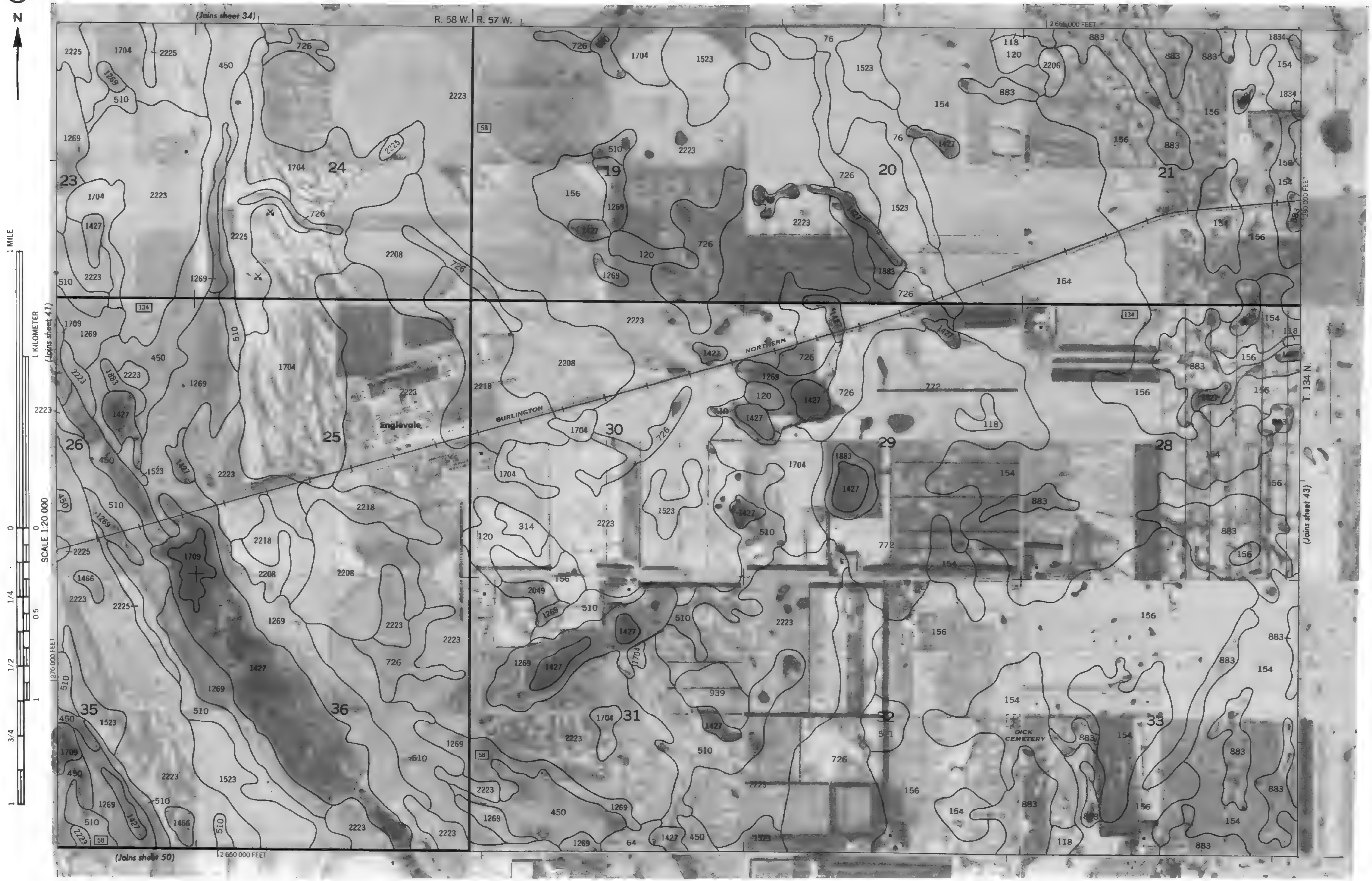
RANSOM COUNTY, NORTH DAKOTA NO. 41



RANSOM COUNTY, NORTH DAKOTA NO. 42

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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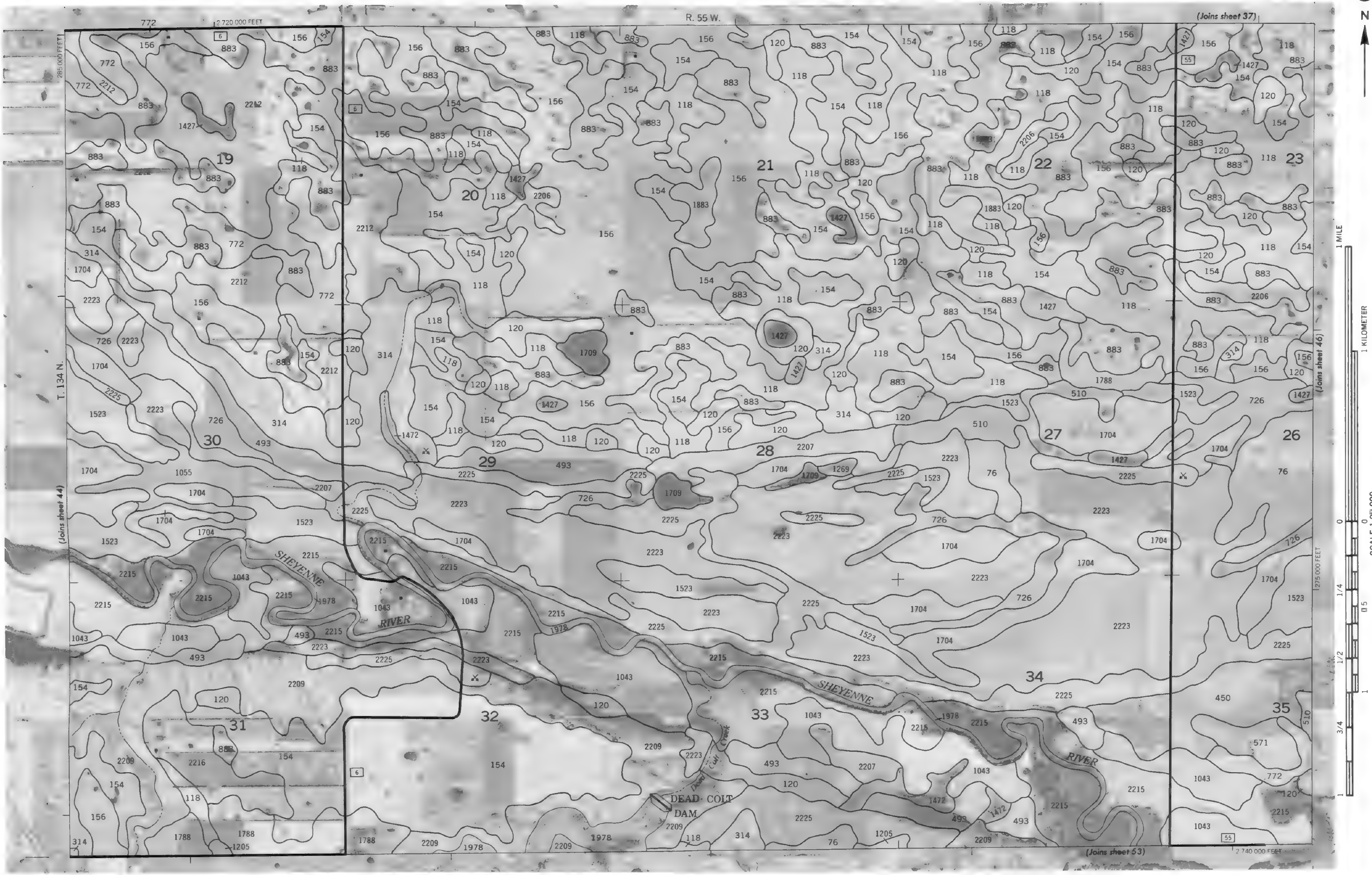
RANSOM COUNTY, NORTH DAKOTA NO. 43

SOIL SURVEY OF RANSOM COUNTY, NORTH DAKOTA — SHEET NUMBER 44

RANSOM COUNTY, NORTH DAKOTA NO. 44

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



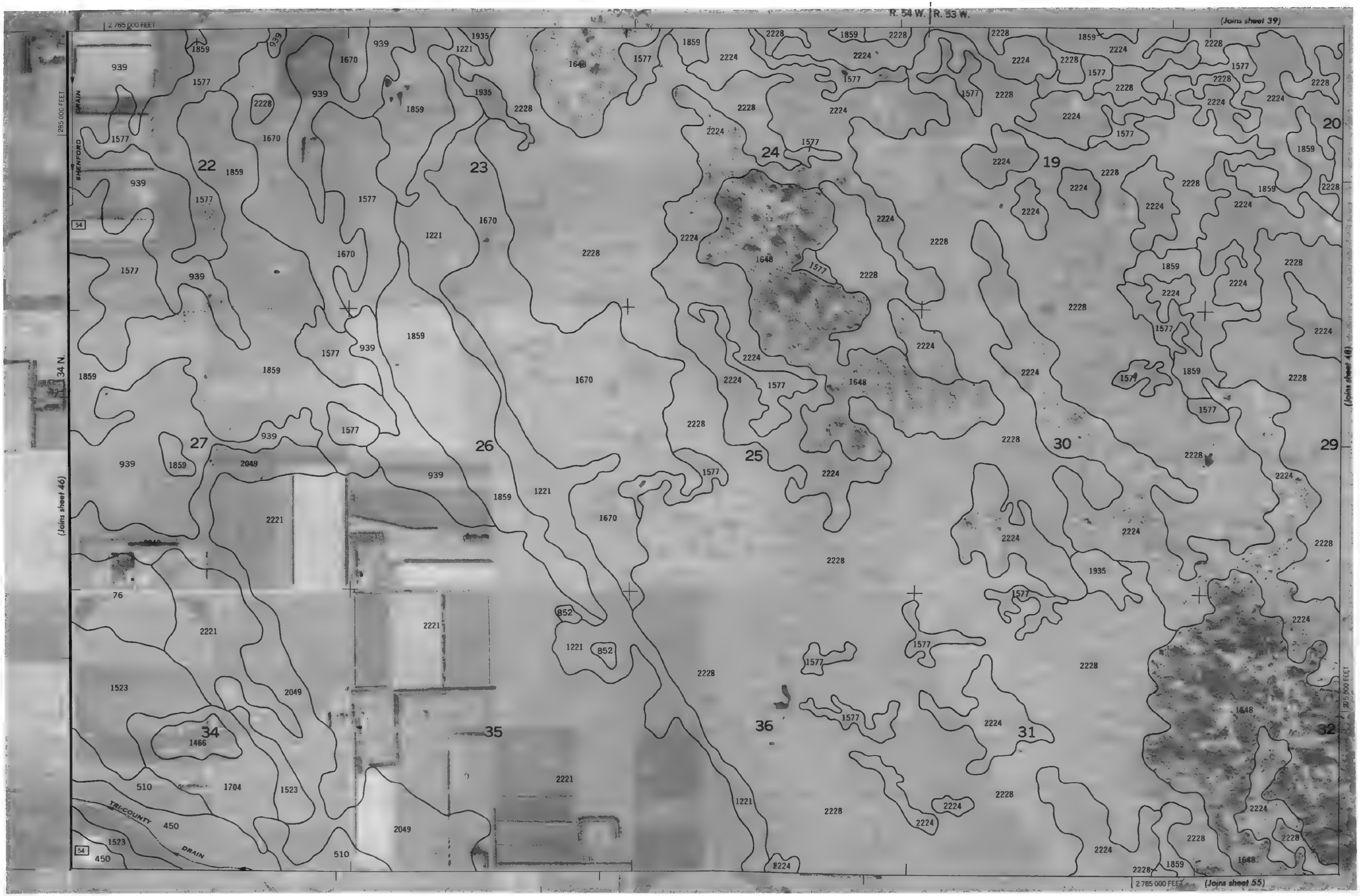
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RANSOM COUNTY, NORTH DAKOTA NO. 45

SOIL SURVEY OF RANSOM COUNTY, NORTH DAKOTA — SHEET NUMBER 46

RANSOM COUNTY, NORTH DAKOTA NO. 46

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



N

SCALE 1:20 000

1 MILE

1 KILOMETER

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RANSOM COUNTY, NORTH DAKOTA NO. 47

SOIL SURVEY OF RANSOM COUNTY, NORTH DAKOTA — SHEET NUMBER 48

RANSOM COUNTY, NORTH DAKOTA NO. 48

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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RANSOM COUNTY, NORTH DAKOTA NO. 49

RANSOM COUNTY, NORTH DAKOTA NO. 50

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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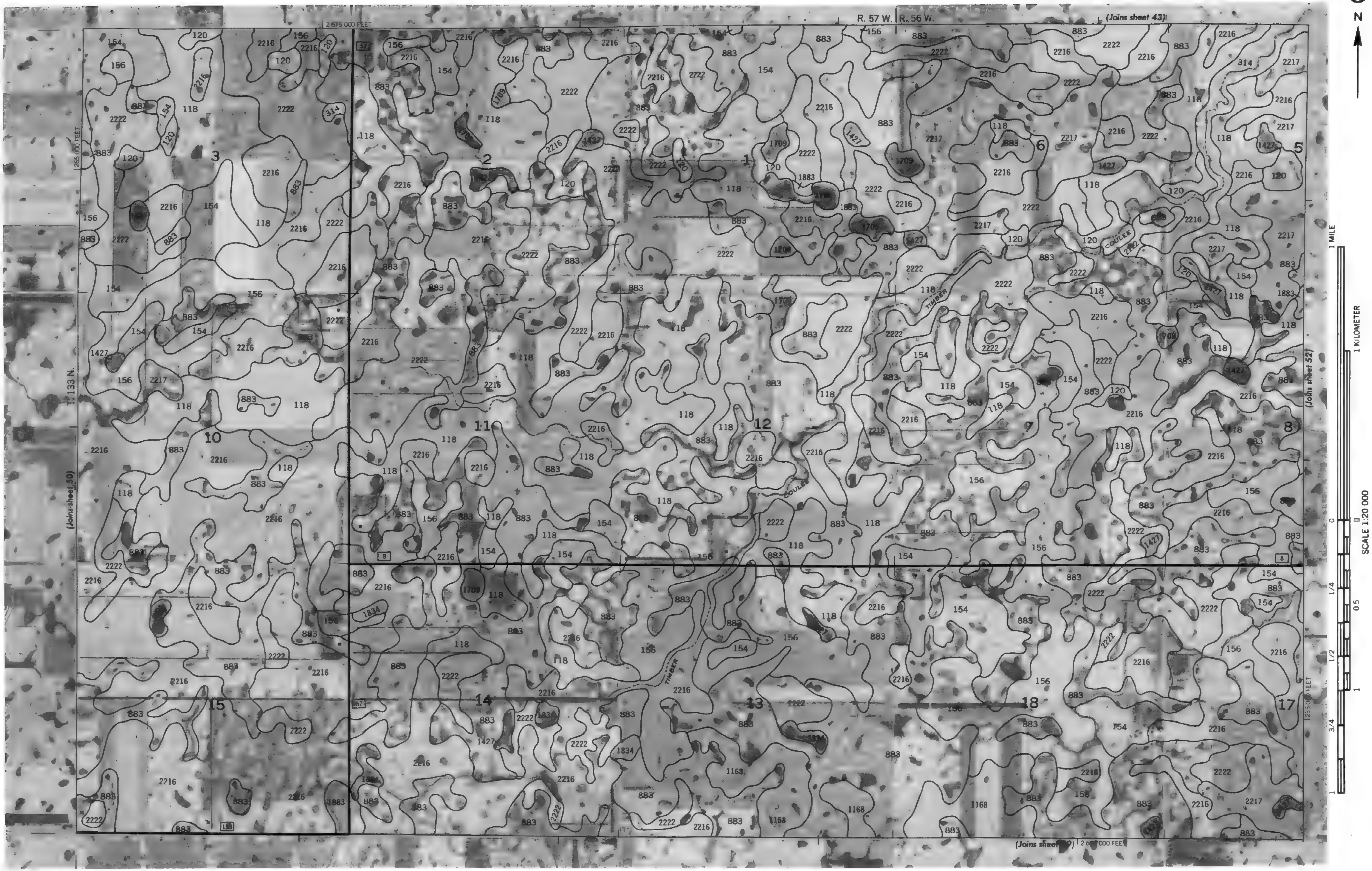
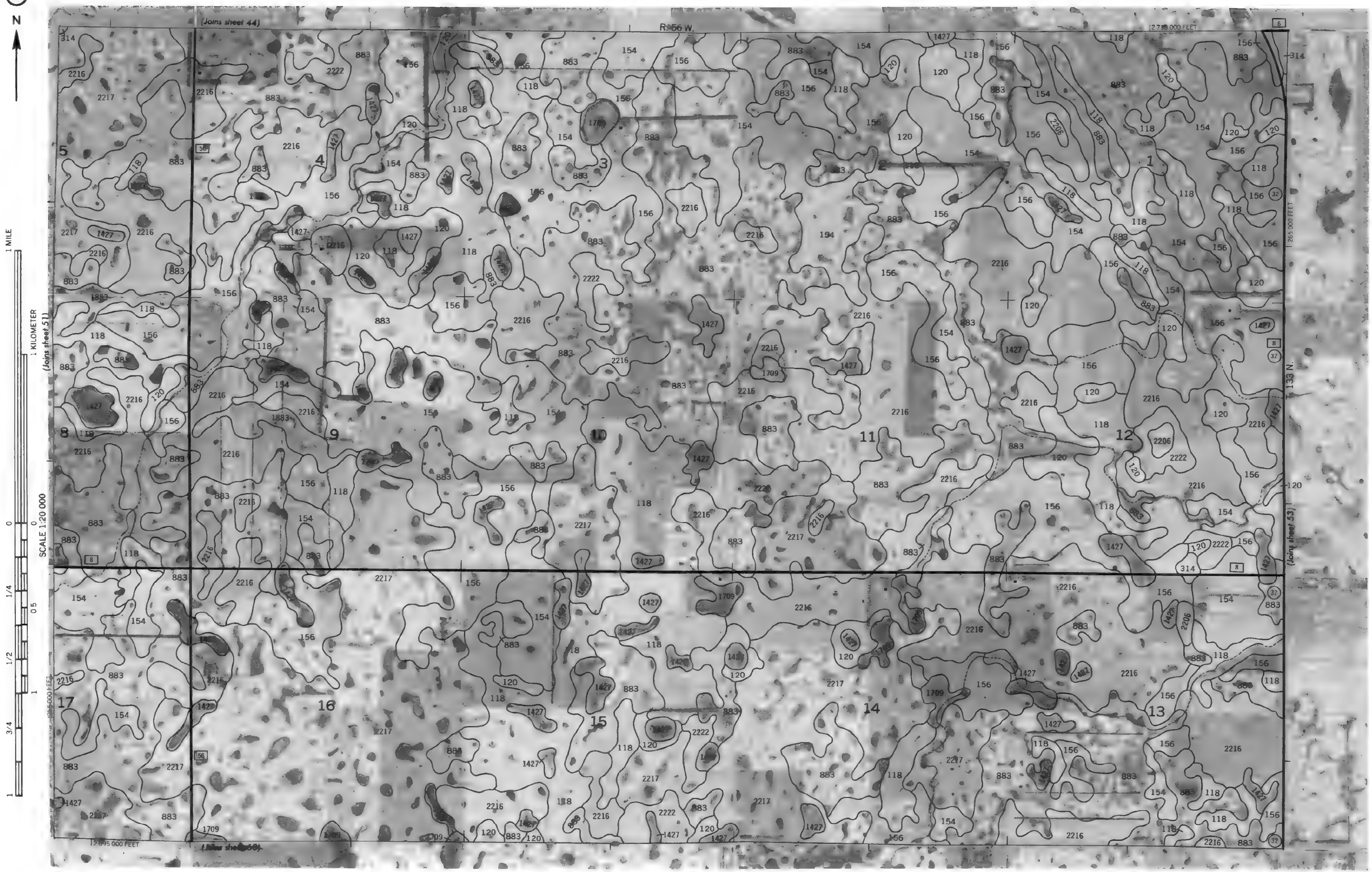
RANSOM COUNTY, NORTH DAKOTA NO. 51



SOIL SURVEY OF RANSOM COUNTY, NORTH DAKOTA — SHEET NUMBER 52



RANSOM COUNTY, NORTH DAKOTA NO. 52

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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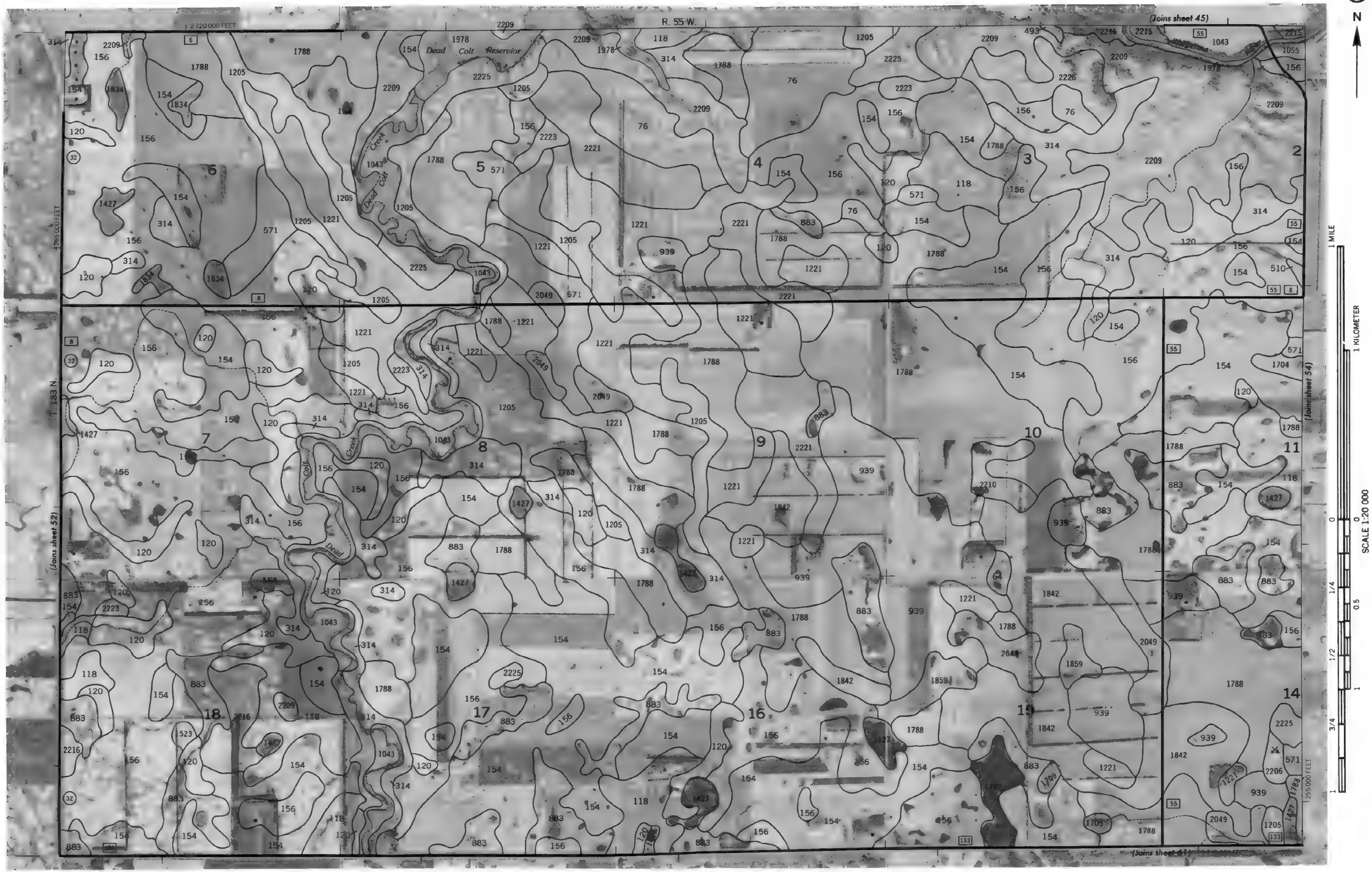
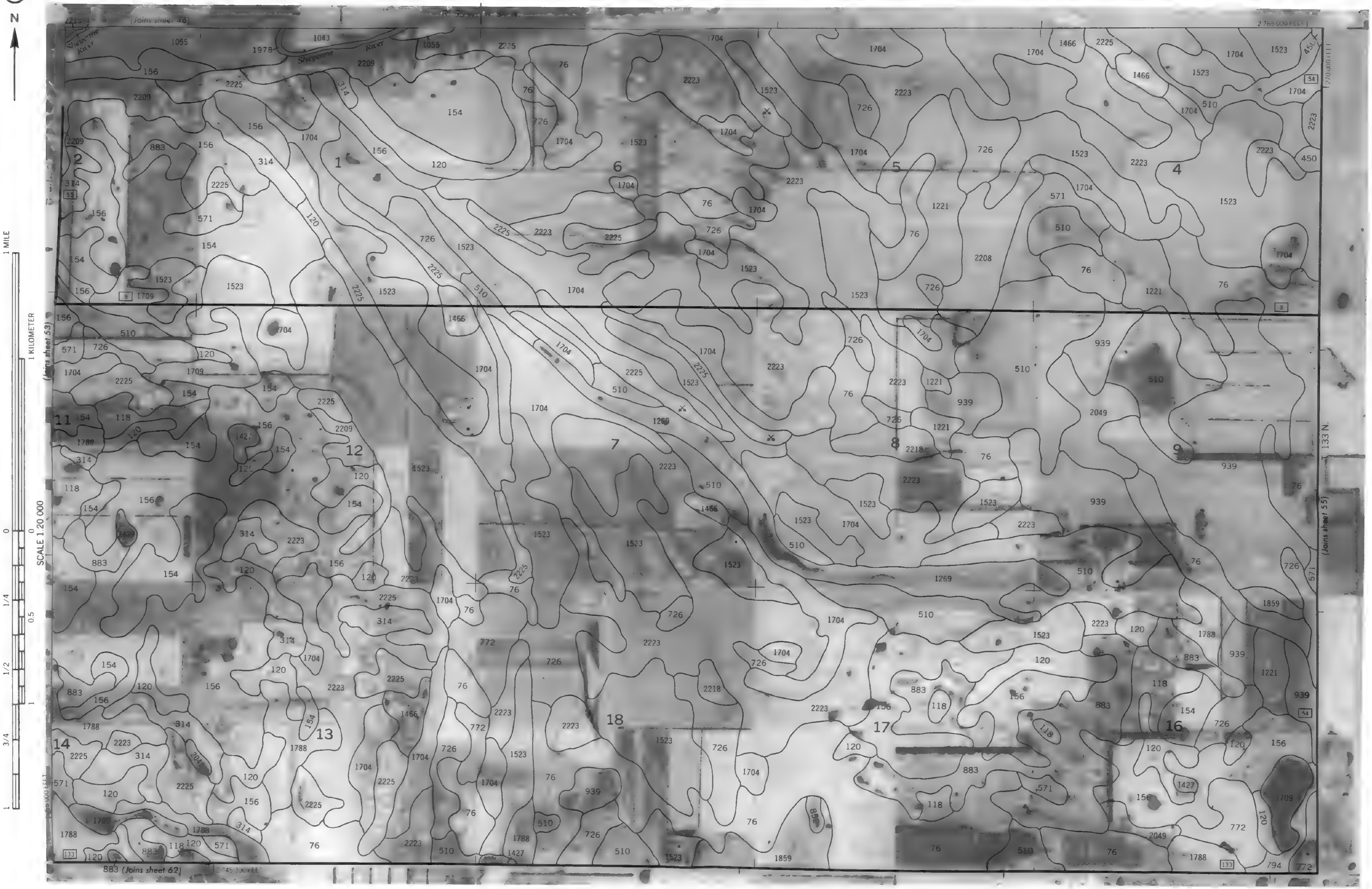
RANSOM COUNTY, NORTH DAKOTA NO. 53





RANSOM COUNTY, NORTH DAKOTA NO. 54

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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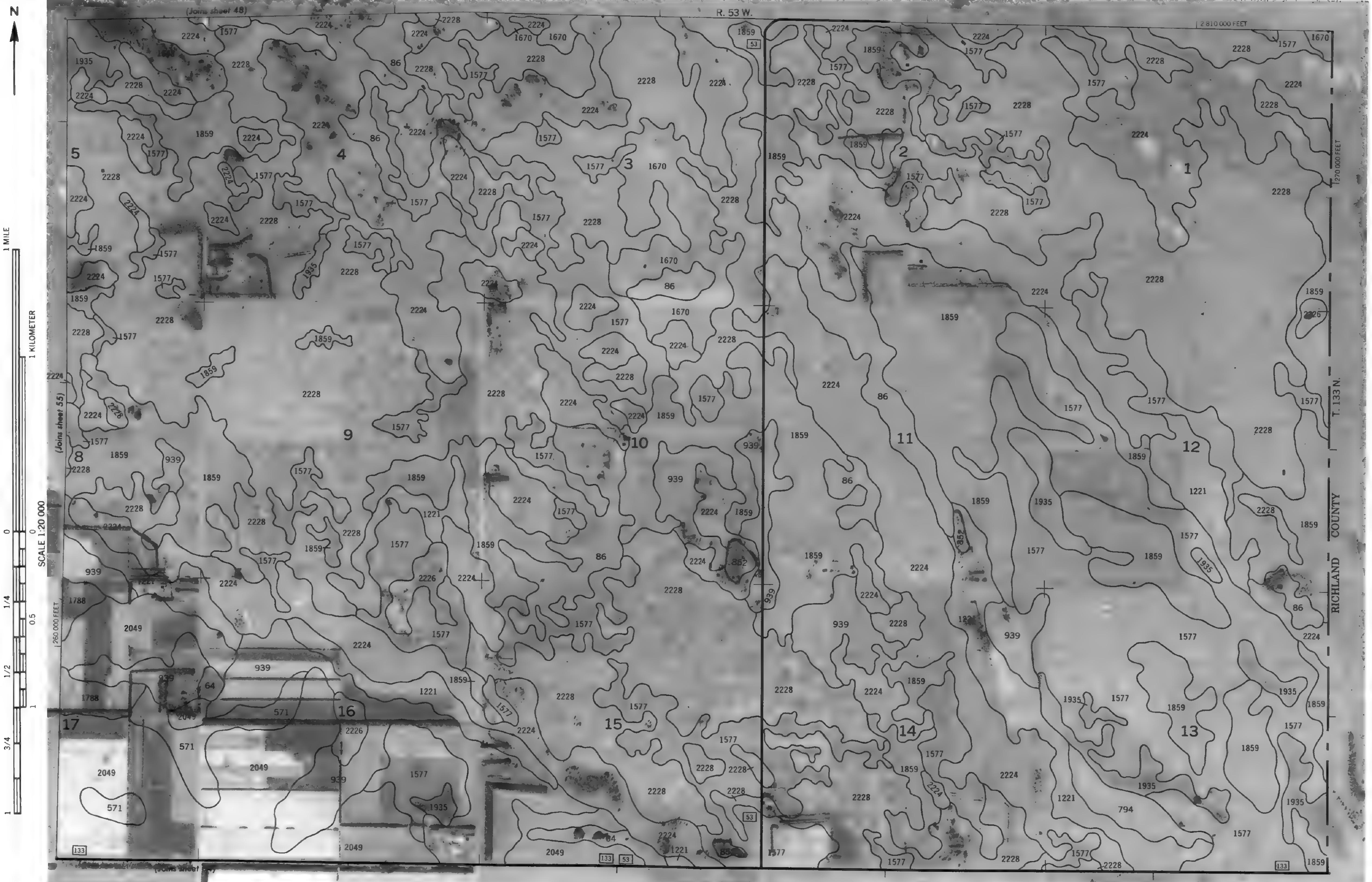
RANSOM COUNTY, NORTH DAKOTA NO. 55



RANSOM COUNTY, NORTH DAKOTA NO. 56

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RANSOM COUNTY, NORTH DAKOTA NO. 57

RANSOM COUNTY, NORTH DAKOTA NO. 58

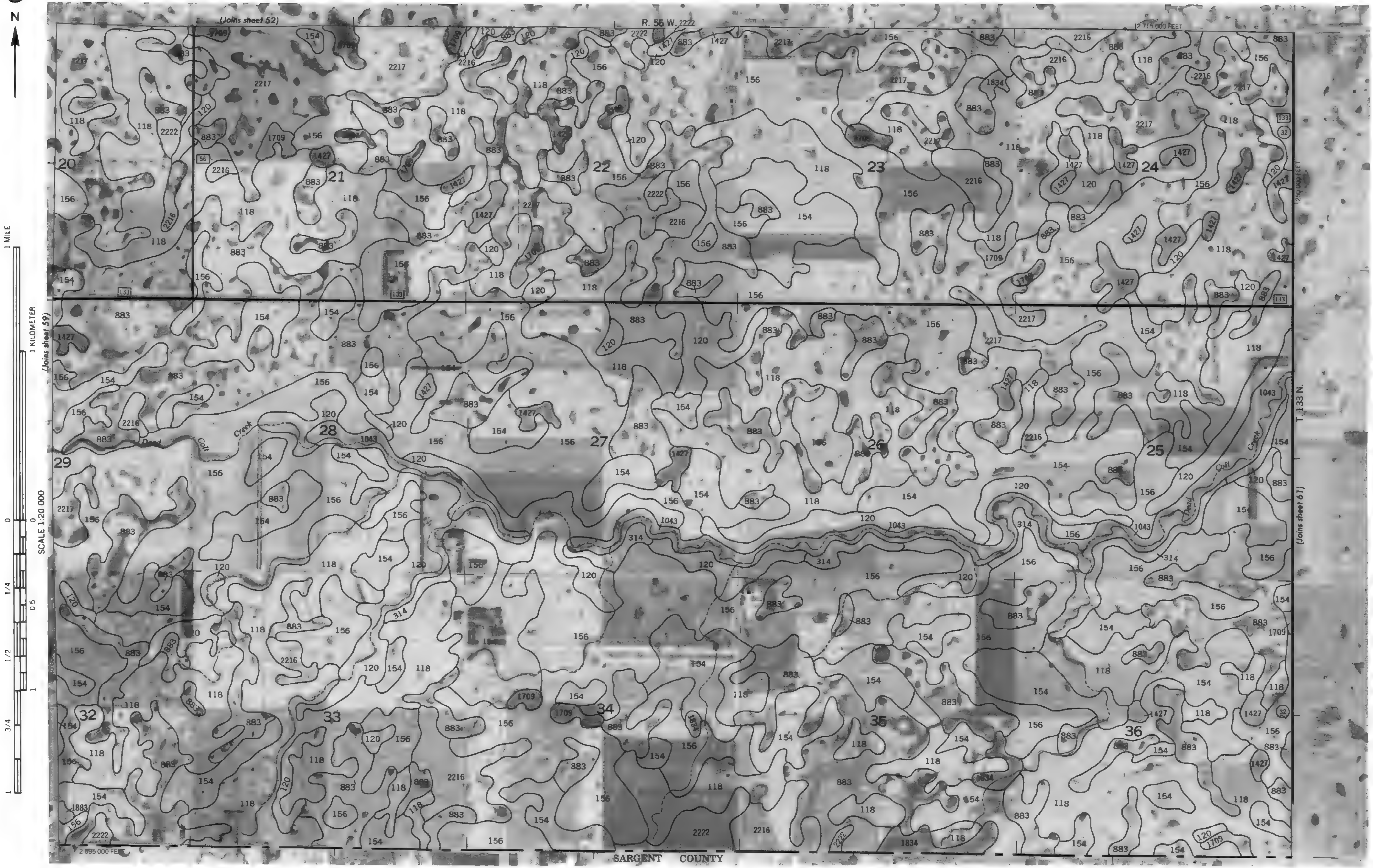
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

59

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RANSOM COUNTY, NORTH DAKOTA NO. 59

SOIL SURVEY OF RANSOM COUNTY, NORTH DAKOTA — SHEET NUMBER 60



RANSOM COUNTY, NORTH DAKOTA NO. 60

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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RANSOM COUNTY, NORTH DAKOTA NO. 61

SOIL SURVEY OF RANSOM COUNTY, NORTH DAKOTA — SHEET NUMBER 62

N

1 MILE

1 KILOMETER

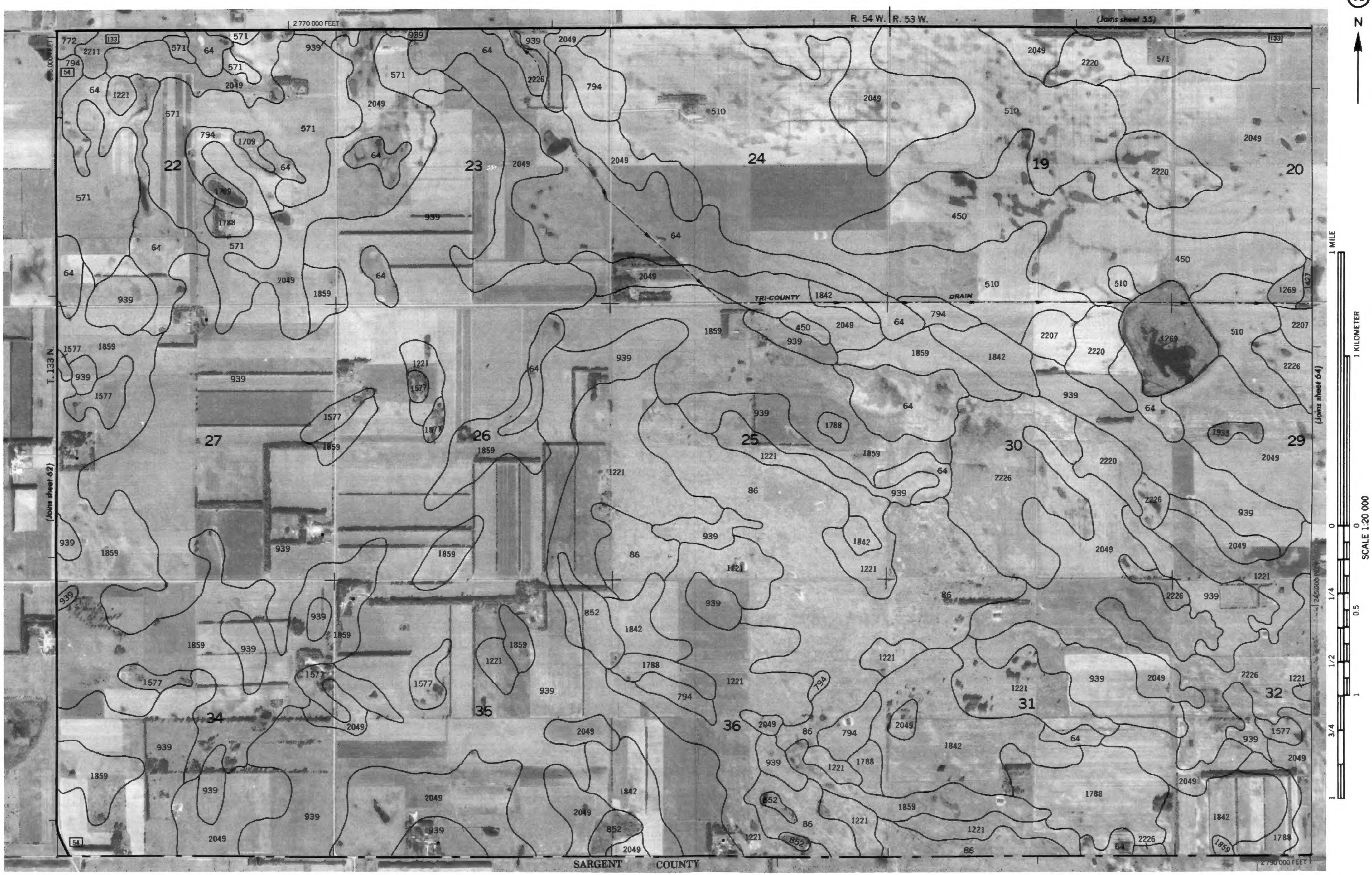
SCALE 1:20 000

0 1/4 1/2 3/4 1

0 0.5 1

RANSOM COUNTY, NORTH DAKOTA NO. 62

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

RANSOM COUNTY, NORTH DAKOTA NO. 63

HANSOM COUNTY, NORTH DAKOTA NO. 64

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.